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THE WILSON BULLETIN

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THE WILSON BULLETIN
A QUARTERLY MAGAZINE OF ORNITHOLOGY
Published by the Wilson Ornithological Club

Vol. 51 JUNE, 1939 No. 2

TERRITORIAL STUDIES ON THE EASTERN GOLDFINCH [1]

BY MARGARET DRUM

THIS study of the Eastern Goldfinch, *Spinus tristis tristis*, was made at the University of Michigan Biological Station near Cheboygan, Michigan, in the summers of 1937 and 1938. I arrived at the Station July 1, 1937, and remained until August 23. The following year, I arrived June 25 and left August 22. Goldfinches were an abundant species there at the Station. Since they nest late, I had a good opportunity to study their territorial activities before nest building began, as well as throughout the nesting period.

Very fine territorial studies have been made on certain species. Two notable examples are Mrs. Nice's work on Song Sparrows (1937) and Harry W. Hann's on the Oven-bird (1937). At the time no detailed study of this problem had been made on the Goldfinch. This species presented, it seemed to me, an unusually interesting problem, as Goldfinches, unlike many species, may be seen together throughout the summer, feeding and apparently enjoying each other's company, and by some authorities they have been considered to be a non-territorial species.

In considering this problem five questions interested me:

1. Do Goldfinches have territories with definite boundaries?
2. When are these territories established?
3. Are these territories defended from individuals of the same species?
4. How large are these territories?
5. What activities take place within the boundaries of these territories?

I have been able to answer some of these questions and throw light on others. No one realizes more than I how much remains to be done.

HABITAT

The Biological Station lies on the shore of South Fishtail Bay of Douglas Lake, Cheboygan County. There is a gentle slope back from the lake, extending from 50 to 100 feet. On this the laboratories and cabins are built. The slope then rises abruptly for 50 feet or more and levels out 100 feet to the east and 500 feet to the west. The slope is less steep on the other side of the hill and falls gradually into a

[1] Contribution from the University of Michigan Biological Station.

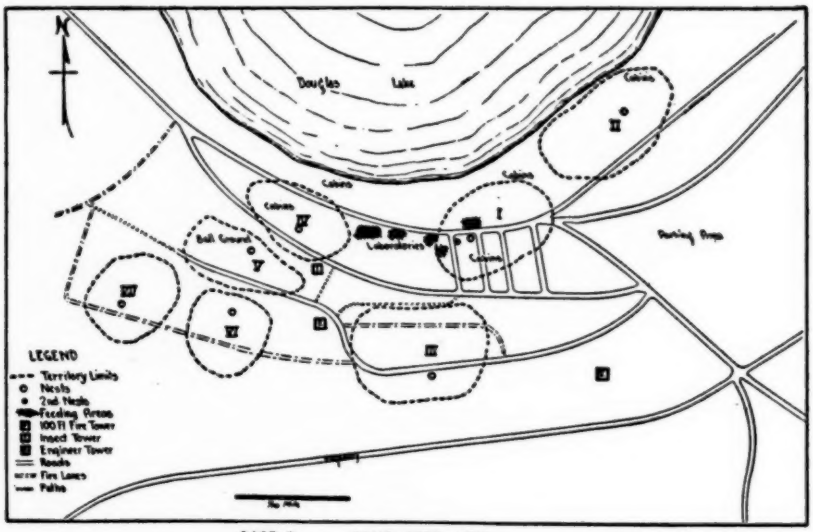
gorge, a mile south of which is Burt Lake. The area is largely a maple-aspen association with scattered pine, oak, and white birch. Pin-cherry, June-berry, and sumac are common. The ground cover is catchfly, pteris, and blueberry. It would be classified as an open woods.

Throughout the whole area are paths, fire lanes, and roads. A highway passes on the south side of the hill before it descends into the gorge. A 100-foot fire tower and two smaller towers, an insect and an engineer tower, are on the hill. (See maps.)

Methods of Study

I began my study each year by visiting every part of the camp area, going north as far as Pine Point, west to Grape Vine Point, and back from the lake to the highway. I checked this territory again and again. Every Goldfinch was recorded and its activity noted. Careful notes were kept in the field. Sketches were made of each day's trip and the exact time of each trip was recorded. Special attention was paid to flights of singing males. Rough diagrams were drawn to show how much territory they covered and where they alighted. Pairs seen together were of special interest.

I used no blinds until nest building began, but usually sat quietly, partly concealed by a shrub. I checked flights from the high fire tower and from the smaller engineer and insect towers. This method of observation enabled me with the aid of field glasses to see the whole field, to record the complete circle made by each singing male, and to note in what group of trees a pair most frequently alighted. I would follow these observations with a visit to these localities and remain quietly for several hours waiting for the birds to return.



MAP I CAMP AREA 1937

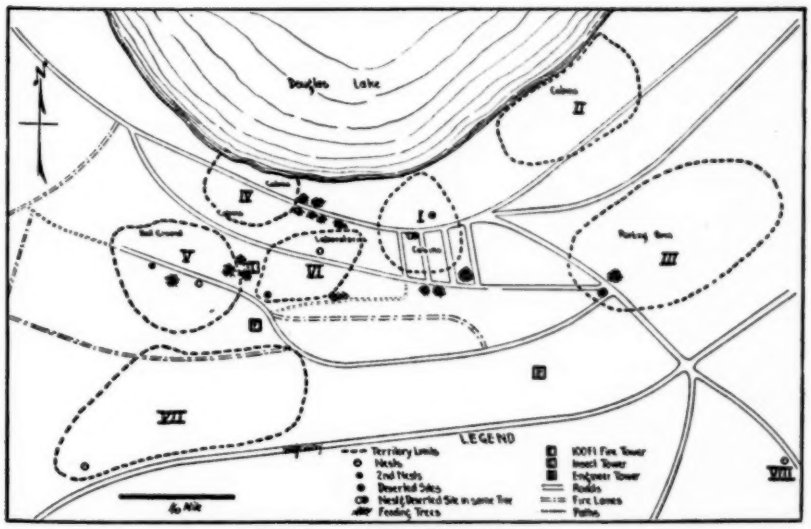
Feeding Ground and Territory

When I arrived on July 1, 1937, the Goldfinches were feeding in the birch trees near the laboratories (see Map I). At first only a few trees had catkins mature enough for food. Later there were a dozen or more, all confined to the center of camp. I checked 300 white birches outside this area and found only three with catkins. When I arrived the next year on June 25, none of the catkins were mature. The Goldfinches were feeding on chickweed, wild lettuce, and the seeds of June-berry. The fact that the feeding areas were widely scattered increased the difficulty of locating nesting territories. Even later when the food became largely birch catkins this fact remained true, as every small birch throughout the whole area was heavily laden with catkins. While this situation increased the difficulty of finding territories, it aided me in determining their exact boundaries as pairs of Goldfinches do not customarily feed in one another's territories.

Flight and Song in Relation to Territory

I found songs and call notes second to flight in aiding me to discover territories. But these sounds and flight are so closely associated in this species that I will consider them together.

Goldfinches make periodic flights from their feeding areas to their nesting territories. Before nest building began pairs were seen feeding together. After nest building began the female was seen less often in the feeding area. Frequently a male would rise from the feeding area, circle once or twice, then fly directly toward his nesting territory, which



MAP II CAMP AREA 1938

might be a mile or more distant. Sometimes several males would rise at the same time, circle and sing the typical male song. Each would then fly to his nesting territory. I watched these flights with field glasses from hilltops, trees, tower blinds, the insect tower, the engineer tower, and the 100-foot fire tower. From these elevated positions I could see the flights of most of the pairs studied. I remained at these points of observation hours at a time, and sketched the flights of each bird in relation to fixed points as buildings, highways, fire lanes, and tall trees. The course of each flight was easy to follow because of the undulating flight and the *per-che-che* flight song, given at each upward bound. Later I would follow these paths of flight and watch and wait for the male or the pair to fly over. Occasionally these flights led to feeding areas, but when a single male or a pair flew again and again over a given path I could be sure it would lead to a nesting territory.

If the male was alone, he would seldom alight in his territory, but would circle over it several times, his flight roughly defining its boundaries, and then return to his feeding area. If accompanied by his mate or if the female was in the nesting territory, busy with building, he would circle the area, hover, sing the male song, and circle again. This performance might be repeated many times. He would then join his mate at the nesting site. The female, whether accompanied by the male or alone, flew directly to the group of trees where the nest was to be built. The exact location seems not to have been chosen until shortly before nest building began.

I have tried many times to record the song of the male phonetically, but it is so diversified, rapid, and canary-like that I have never succeeded in doing so. There was very little male singing during the last week of June. The songs that were heard were short. They became fuller and more varied as nest building time approached and were strongest the second and third weeks in July. During the egg-laying and brooding periods the songs are heard less often, but there is another period of singing when young are in their nests. These songs were seldom as varied and full as during the nest building period.

I was never able to recognize males by their warbling song, but I recognized several of them by their flight songs which were quite characteristic and varied as to number, spacing, and inflection of syllables. These songs are usually uttered at each upward bound, but one bird was frequently silent for a bound or two. The usual song was *per-che-che*. One varied this with a definite *per-chic-o-re* described by Chapman. One male interspersed the *per-che-che* song with a *per-che-ow* with a downward inflection on the last syllable. Another used a two-syllable song as *per-che, per-che, per-che-che, per-che*.

I have never noticed a female give any song but a soft *per-che-che* when in flight. But they gave varied and characteristic responses to their mates when they came into the territory. It was usually a variation of the *per-che-che* song or a rapid repetition of the syllable *we*

without change of tone, but with an increase in rapidity and a decrease in loudness as the male approached the nest.

If I came upon them in their territory, both sexes gave a questioning *sweet*. It has the same notes as their *swe-et sweet* calls heard in the feeding trees, but of an entirely different tone. The more disturbed they were, the louder and harsher the notes. If their nests were disturbed, both sexes would utter a "cry-baby" call similar to that of a juvenile Baltimore Oriole. In fact one nest of young Orioles caused me a great deal of trouble, for at a distance I would mistake them for Goldfinches. This "cry-baby" call of the Goldfinch is plaintive, monotonous and nerve wearing. Mousley (1930:255) records this call as *bare-bee, bare be beeb, beeb, beeb, ba be.* If the cause for alarm disappeared, they would intersperse their *ba-be-be-be* notes with a *sweet sweet* and then forget all about it. I located most of the territories by the periodic flights of pairs or the singing males. The nests within the territory were located by the characteristic calls of the birds in the nesting trees.

Extent of Study

I have records of 15 pairs of Goldfinches within the camp area, seven for 1937 and eight for 1938. Two pairs (I., 1937; V., 1938) renested when their first nest was destroyed. One territory (II., 1938) was studied, but the nest was never found. Four nests were found too late for study of territory or were located where close observation was not feasible (IV. and VI., 1937; IV. and VIII., 1938). The territory and nests of ten pairs were studied in detail. I spent about 450 hours in this study.

By the activity of the birds, I was able to locate most of the territories before nest building began and observed the carrying of first materials in four cases (I. and III., 1937; I. and V., 1938). Territory III., 1937 was definitely located fourteen days before any nesting materials were carried. It is interesting to note that the boundaries of three of the territories in 1938 (I., II., V.) were very nearly the same as three corresponding ones in 1937 and that Goldfinches built in the same tree in territory I. for three consecutive years. Since no banding had been done, there is no way to know whether these were returns.

Size of Territory

The territory defended by the male, in all cases observed, consisted of at least a few trees and in two cases was more than 100 feet long and 50 feet wide. I measured these distances by pacing. The flights of the circling male apparently define the boundaries of a territory fairly well and coincided with the territory defended in the four territories where defense was observed. The more distant the territory from the common feeding area and the more secluded the territory, the larger it

seemed to be, judging from the flights of the singing male. Territory III. and VII. in 1938 were at least 1,000 feet long and half that width (see map). Whether the males would have defended this large a territory is unknown, as no Goldfinches were seen to alight within their boundaries. On an average the territories were a half acre or more in extent. In Lawrence H. Walkinshaw's recent paper on this species (1938:5) he says, "Although I have spent many hours in the field, I have never observed conflict between birds. Nests after construction, have been found occupied at the same time only fifty feet apart and in one place there were seven nests on a small triangular area, the sides of which were 370, 150, and 240 feet distance." This seems to indicate that where areas are more congested, territories are smaller. No two nests in the region I studied were closer than 30 feet.

Choosing of Nesting Sites

There seems to be no favorite location for the nest within the territory, nor was it placed with any relation to the feeding ground. Often it was placed near the center; twice they were placed very near one side and but a few rods from a common feeding ground. Twice they were placed at the other end of the territory as far distant from the feeding ground as possible.

In 1938 two pairs abandoned their original sites after carrying material. One pair had carried but a little web and had been observed at the site but three times. A few days later I found a partially constructed nest 30 feet up in a tree. I believe these sites belonged to the same pair, since the male at each site included both locations in his territorial flights and the new nest was begun at about the time the first nest was abandoned.

The other pair was recorded from the day of my arrival, June 25. The flights of the male was observed daily and its favorite trees noted. I observed the female carrying her first material July 6, and for two days she built industriously. By the morning of July 9 two limbs were well covered with web, but no birds were near. The next morning the female was building in a high limb of a maple about four rods from the deserted nest. I watched the female carry material. She was still building that afternoon. I did not check this area again until the next afternoon, July 11, when I found a nest being built on a limb ten feet lower, and five feet to the left. The female was busily working here and no other Goldfinches were about. The next morning I saw a female fly to the upper limb and at first I thought that two females were building in the same tree, but they proved to be the same bird. She was taking web from the deserted site to use in her nest. I believe the three sites belonged to the same pair not only because the flights of the male were the same, but also because only one pair was seen in this territory and the male of the third site drove out intruders from the tree into which the first material had been carried.

Activity of Male in Territory

There seems to be a great variation as to the amount of time males spend in their territories. Two males spent much of their time in white birch trees near their nests (I., 1937; I., 1938), where they could feel as well as watch. Most of the males made short visits to their territories every hour or so when their mates were building. On the whole they were less watchful during the brooding period. Sometimes they would only fly over the area as if to see that all was well. One male, in 1937 (VIII.), was very negligent of his duties. Although I made frequent visits and remained in the vicinity of the nest hours at a time, I did not see him from the time the first egg was laid until the young were hatched. A pair renested in 1938 (V.) after the first three eggs were tossed out of the nest by a storm. The following day a fourth egg was laid. That afternoon the nest was deserted and by noon the next day a new nest was begun. The male was most attentive at the first nest but much less so at the second. This is in contrast to a pair that renested in 1937 (I.) after their nest had been robbed. The male in this case was as attentive at the second nest as at the first. It is possible that the males at the second nests were not the same as at the first but I believe they were. Males were seen with the females during the short time between desertion of the first nest and beginning of the second. In both cases the songs and circling flights of the males were similar and they alighted in many of the same perching trees.

Defending Territory

The males do not allow other Goldfinches to alight in their territory. I have observed males defend their territories on many occasions and in four different territories. I have seen females drive out other females if the males are absent. The males usually have favorite perches from which they dart out at the intruders. Often after the intruder leaves, the male will circle above his territory and sing. While in a tower blind, I saw a fight which took place but a few feet from me. Two males were tumbling over each other making mouselike squeaks. The intruding male soon left and the other male came back to his tree. One fight I observed in the open. The males flew at each other again and again hovering in mid air, striking their bellies together and making sharp squeaks and calls. The ardor of the males wears off when they begin to feed the females and young. Dr. Walkinshaw (1938:5) says, "Many times from a blind, foreign males were seen very near to an occupied nest without causing any disturbance on the part of the rightful owner, but these were usually when nesting was advanced." My notes also indicate that there was little or no defense of the territory after the males began to feed the females at the nest and by the time the nestlings were ready to leave the nest several families might be enjoying each other's society.

Goldfinches seem to get along peaceably with all other species, differing from Mrs. Nice's (1937:67-8) findings on the Song Sparrows in that respect. Vesper Sparrows, Cedar Waxwing, Chipping Sparrows, Baltimore Orioles, Brown Thrashers and Towhees nested within the Goldfinches territories but no conflict was observed at any time.

The females gather most of the material for their nests from within the territory. However, if suitable material is not to be had within their boundaries the female may fly a considerable distance. I have traced several a half mile or more to their nearest source of thistledown. To get this they flew over another's territory.

Dr. Gross (1938:253) states that "Sometimes the male brought nesting material but this was usually presented to his mate who packed it firmly into the growing walls of the structure." I did not observe this at any of my nests. The female alone gathered nest material and did all the building.

Acknowledgments

The author wishes to express her appreciations for the inspiration and help given her by the late Dr. Frank N. Blanchard; and to make grateful acknowledgment of her indebtedness to Dr. Olin S. Pettingill, Carleton College, Minnesota, for guidance and for critical reading of the manuscript. I am indebted also to Miss Theodora Nelson, Hunter College, New York City, for advice and encouragement and to Dr. T. S. Roberts, University of Minnesota, who has kindly opened his private files and library to me.

Summary

Much remains to be done on territory in Goldfinches. I draw the following conclusions on the basis of my observations on fifteen nests found in the open woods in the vicinity of the Biological Station in northern Michigan.

Feeding Area and Territory

1. Goldfinches have a common feeding area which may be a mile or more from their nesting site.
2. These feeding areas are scattered when the food is plentiful, but may be concentrated into a small area when food is scarce.

Flight and Song in Relation to Territory

1. Goldfinches choose their nesting territory two weeks or more before nesting begins, in northern Michigan at least as early as June 25.
2. This territory has definite boundaries that are roughly defined by the circling flight of the singing male.
3. The male begins singing the warbling song early in the season, but this song is fullest and most varied during nest building time.

4. The flight song in both sexes, uttered on the upward bound of its undulating flight, is a variation of the syllables *per-che-che*.
5. The female uses a variation of the *per-che-che* song in answering her mate when he comes into the territory.
6. The alarm call of both sexes when disturbed is *ba-be-be*. This is often combined with the *sweet-sweet* calls.

Choosing the Nesting Site

1. The site of the nest within the territory is not chosen until shortly before nest building begins and may be changed after a nest has been started.
2. The nest may be placed in any part of the territory. Boundaries or feeding area appear to play no part in the selection of the site.

Activity of the Male in the Territory

1. Males vary as to the amount of time they spend in the nesting territory, but usually make short visits every hour or so.
2. Some males begin feeding the females by regurgation when incubation begins, others not until the eggs hatch.
3. The males continue to feed the female until the nestlings are five to eight days old.

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Owatonna, Minnesota.

ADDITIONAL INFORMATION ON THE FOOD OF THE AMERICAN WOODCOCK

BY OLIN SEWALL PETTINGILL, JR.

IN May, 1933, I received from Mr. Robie W. Tufts, Chief Migratory Bird Officer of the Maritime Provinces, 207 adult American Woodcock (*Philohela minor*). These birds were seized for a violation of the Migratory Bird Treaty Act, having been retained in cold storage much longer than the time prescribed by law. All of these birds were taken in Nova Scotia in the counties of Halifax, Queens, Digby, and Annapolis, A few may have been taken in Yarmouth County. They were killed during October of the years 1927 to 1932 inclusive. The stomachs from 70 of these Woodcock were recently examined by Mr. C. C. Sperry of the Denver Laboratory of the U. S. Bureau of Biological Survey. The results of the examinations warrant a brief report for they contribute additional information to an account already published (Pettingill, 1936, 251-257) on 124 Woodcock stomachs examined at Cornell University.[1]

Vegetable Food

Small seeds were found in fifty-nine stomachs, amounting to 4.23 per cent of the total food. While one stomach contained as many as 84 seeds (74 *Rubus* sp., 4 *Carex* sp., 2 *Viola* sp. and 4 unidentified seeds), the seventy stomachs averaged only 9.52 seeds each. Other forms of vegetable material such as plant fibers, veins of leaves, and small rootlets were of so small a quantity as to be considered negligible in estimating the percentage of food content.

Table 1 shows the kinds of seeds found in the stomachs examined by the Biological Survey together with the number of stomachs in which they were found. To this table are added for comparative purposes the findings made at Cornell University.

A study of this table shows that the Biological Survey identified 20 genera of seeds not found at Cornell University and observed the repetition of only six genera. It is interesting to note that the seeds of *Rubus* and *Carex* occurred more often than other kinds of seeds in *both* the stomachs examined by the Biological Survey and those examined at Cornell University.

As I have previously stated (ibid., 253) these seeds were probably not ingested for food purposes. Rather were they taken in either as a form of grit used in digestion or taken in accidentally by sticking to the moist bodies of certain animals upon which the Woodcock had presumably fed. Since making this statement a third method of ingestion

[1] The stomachs examined at Cornell University were taken from birds collected in the vicinity of Ithaca, New York, and Cape May, New Jersey. All were obtained between 1930 and 1933.

has come to my attention, namely, the taking of seeds into the stomach that were contained in the digestive tracts of earthworms devoured.

TABLE 1

SEEDS FOUND IN WOODCOCK STOMACHS EXAMINED BY THE BIOLOGICAL SURVEY AND AT CORNELL UNIVERSITY

Name of Seed		Examinations by the Biological Survey (70 stomachs)	Examinations at Cornell University (124 stomachs)
		Number containing	Number containing
Panicum sp.	Panic Grass	6	1
Setaria sp.	Bristly Foxtail Grass	..	1
Setaria lutescens	Golden Foxtail Grass	..	7
Setaria viridis	Green Foxtail Grass	..	1
Phleum pratense	Timothy or Herd's Grass	..	1
Cyperus sp.	Galingale	6	..
Psilocarya sp.	Bald Rush	3	..
Scirpus sp.	Bulrush	3	..
Carex sp.	Sedge	38	17
Juncus sp.	Rush	3	..
Betula sp.	Birch	2	..
Alnus sp.	Alder	8	..
Rumex sp.	Sorrel	..	6
Rumex Acetosella	Sheep Sorrel	..	3
Polygonum sp.	Knotweed	2	15
Polygonum Convolvulus	Black Bindweed	..	1
Amaranthus sp.	Amaranth	..	1
Panunculus sp.	Buttercup	..	1
Brassica sp.	Mustard	..	16
Mitella sp. (?)	Miterwort	6	..
Fragaria sp.	Strawberry	4	..
Duchesnia sp.	Indian Strawberry	1	..
Potentilla sp.	Cinquefoil	20	..
Rubus sp.	Bramble	37	26
Melilotus sp.	Melilot or Sweet Clover	..	1
Ilex verticillata	Holly	1	..
Viola sp.	Violet	36	..
Hippuris sp.	Mare's-tail	1	..
Aralia sp.	Sarsaparilla & Spikenard	1	..
Vaccinium sp.	Blueberry & Cranberry	1	..
Cuscuta sp.	Dodder	3	..
Lippia sp.	Fog-fruit	1	..
Solanum sp.	Nightshade	4	..
Plantago sp.	Plantain	4	1
Galium sp.	Bedstraw	8	..
Lonicera sp.	Honeysuckle	1	..
Sambucus sp.	Elder	2	1
Compositae	Composite	1	..
Unidentified seeds		6	..

ANIMAL FOOD

Animal matter was found present in all 70 stomachs and composed 95.77 per cent of the total food.

Evidences of earthworms were found in all but one stomach, making up 85.78 per cent of the total food. Fourteen stomachs contained no

other food. These 70 stomachs emphasize even more than the stomachs examined at Cornell University the pronounced selectivity of Woodcock diet and the importance of its specialized probing habits.

The remaining 9.99 per cent of animal food consisted of the following groups:

Name	Per cent food
Isopods	.07
Millipedes	.14
Centipedes	.03
Spiders	.74
Insects—	
Beetles	3.63
Caddis-flies	.09
Caterpillars	1.14
Fly larvae	4.03
Hymenopterons	.11

One Woodcock stomach possessed several vertebrae of a minute salamander. This is the first known instance of a Woodcock having fed upon a chordate animal.

Table 2 summarizes the data on animal food in the seventy stomachs examined. Included here also are the tabulations on animal food in the 124 Woodcock stomachs examined at Cornell University.

TABLE 2

SUMMARIZED DATA ON ANIMAL FOOD IN WOODCOCK STOMACHS EXAMINED BY THE BIOLOGICAL SURVEY AND AT CORNELL UNIVERSITY

	Examinations by the Biological Survey (70 stomachs)		Examinations at Cornell University (124 stomachs)	
Name of Food	Number Containing	Per Cent Containing	Number Containing	Per Cent Containing
OLIGOCHAETA (Earthworms)	69	98.57	52	48.57
CRUSTACEA				
Isopoda (Isopods)	1	1.42	..	....
DIPLOPODA (Millipedes)				
Julidae	1	1.42	..	....
Polydesmidae	1	1.42	..	....
Unidentified Millipedes	..	....	1	0.80
CHILOPODA (Centipedes)				
Geophilidae	2	2.85	..	....
Unidentified Centipedes	..	....	11	8.87
ARACHNIDA (Spiders)	28	40.00	..	....
HEXAPODA (Insects)				
Hemiptera				
Lygaeidae (Chinch-Bugs)	1	1.42	..	....
Coleoptera				
Carabidae (Ground-Beetles) Consisting of both adults and larvae	28	40.00	8	6.45

(Continued on next page)

TABLE 2 (cont'd)

Name of Food	Biol. Surv. (70 stomachs) Number Containing	Biol. Surv. (70 stomachs) Per Cent Containing	Cornell (124 stomachs) Number Containing	Cornell (124 stomachs) Per Cent Containing
Staphylinidae (Rove-Beetles) Consisting of both adults and larvae	11	15.70	2	1.61
Scarabaeidae (Lamellicorn Beetles)	3	4.28	..	....
Rhynchophora (Snout-Beetles)	2	2.85	..	....
Unidentified Weevils	1	1.42	..	....
Dytiscidae (Predacious Diving-Beetles)	..	....	1	0.80
Tenebrionidae (Darkling-Beetles)	6	8.57	..	....
Heteroceridae (Variegated Mud-Loving Beetles)	1	1.42	..	....
Elateridae (Click-Beetles) Consisting of larvae only	2	2.85	15	11.91
Telephoridae (Telephorid Beetles)	4	5.71	..	....
Hydrophilidae (Water-Scavenger Beetles)	..	....	2	1.61
Unidentified Beetles	2	2.85	..	....
Trichoptera				
Unidentified larvae	1	1.42	..	....
Caddis-fly cases	1	1.42	..	....
Lepidoptera				
Unidentified caterpillars	7	10.00	2	1.61
Pupa cases	3	4.28	..	....
Diptera consisting of larvae only				
Tipulidae (Crane-Flies)	25	35.70	17	13.70
Chironomidae (Midges)	1	1.42	2	1.61
Culicoides sp.	..	....	1	0.80
Tabanidae (Horse-Flies)	1	1.42	..	....
Tabanus sp.	..	....	1	0.80
Chrysops sp.	..	....	3	2.41
Sarcophagidae (Sarcophagids)	1	1.42	..	....
Leptidae (Snipe-Flies)	11	15.7	3	2.41
Bibionidae (March-Flies)	..	....	2	1.61
Bibio sp.	..	....	1	0.80
Stratiomyidae (Soldier-Flies)				
Stratiomyia sp.	..	....	1	0.80
Therevidae (Stiletto-Flies)	..	....	1	0.80
Syrphidae (Syrphus-Flies)	..	....	1	0.80
Acalyptratae (Acalyptrate Flies)	..	....	12	9.67
Muscoidea (Muscoid Flies)	..	....	6	4.83
Unidentified fly larvae	4	5.71	..	....
Hymenoptera				
Formicidae (Ants) including several *Myrmica* sp. and *Formica* sp.	7	10.00	..	....
Chalastrogastra (Saw-Flies)	1	1.42	..	....
Andrenidae (Andrenids)				
Anthophora sp.	1	1.42	..	....
Unidentified hymenopterons	2	2.85	..	....
AMPHIBIA				
Salamander	1	1.42	..	....

A study of Table 2 shows that sometimes the Woodcock feeds on insects that are strictly aquatic. The presence of caddis-fly larvae and cases, predacious diving-beetles, and water-scavenger beetles bears substantial evidence of this fact. To obtain these insects the Woodcock must of necessity feed in water, probably by wading in shallow places. Shelley (1933: 95) has presented field observations that further support this belief. At East Westmoreland, New Hampshire, he watched a Woodcock following along drying stream beds and collecting aquatic life from it. Table 2 also shows that the Woodcock feeds, at least occasionally, on such fast-moving animals as spiders, centipedes, and adult carabid beetles. Thus the Woodcock, while decidedly specialized in its feeding habits, does exhibit at times the traits of its more generalized shore bird relatives.

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HOME LIFE OF THE AMERICAN BITTERN

BY HENRY MOUSLEY

IT is now just twelve years since I found my last nest of the Bittern (*Botaurus lentiginosus*), and I certainly had little hopes of finding one in the area (a suburb of Montreal) that I have been working over and writing about for the past five or six years. However, on May 18, 1938 I flushed a female from the side of a small willow bush which was surrounded by water. Naturally, I kept a sharp look out in the immediate vicinity and a week later (May 25) had the satisfaction of flushing the female off her first egg. The nest was situated in the center of a small cattail bed on a raised mound about eight inches above the water and at this date was certainly somewhat exposed as the cattails had barely begun to send up their new shoots. Three more eggs were laid on successive days; then came a break of a day, the fifth and last egg being deposited on May 30. As already mentioned, the female flushed from her first egg when I was close to the nest, flying away with a croak and discharge of excrement. She was not on the nest, or perhaps I should say I did not see her on it, when I visited the site on May 26, 27 and 28. She flushed off her 4 eggs on the twenty-ninth, but was again not seen on May 30, the date of the laying of the fifth and last egg. From this date to June 17, I only found her at home once, on the third, when she again allowed a close approach before flying off with the usual croak and discharge of excrement. I always found the eggs warm, however, the bird no doubt having just slipped off them and hidden in the surrounding cattails on hearing my approach. I never searched for her as this would have meant trampling down the surrounding herbage with the eventual giving away of the site, no doubt. At no time during the study did I see the male bird. This no doubt was owing to the fact that I was unable to visit the site in the early morning or towards evening, the times when the pumping of the male usually takes place.

The duration of the incubation period of the American Bittern has never been quite clear to me, as in our text books it is said to be about 28 days or, again, not less than a month, but no mention is made as to when this period starts—whether from the laying of the first or last egg. In the present case, it would seem that incubation began on the laying of the first egg and continued more or less until the deposition of the last one, in which case the period was twenty-four days. On June 18 four eggs hatched with the fifth still remaining in the nest. This hatched out five days later on June 23. There was some little difference in the size of the first four young, one especially, seeming a little larger and more active than the others. Curiously enough I find Miss E. L. Turner's account of her experiences with the European Bittern (*Botaurus stellaris*) coincides more or less with mine, for Mr.

B. B. Riviere ("A History of the Birds of Norfolk" 1930: 135) says: "The period of incubation, from the laying of the first egg to the hatching of the first chick, appears to be twenty-five days (E. L. Turner). The eggs hatch on consecutive days and there is always a great difference in size between the oldest and youngest nestling, from which it may be inferred that incubation begins on the laying of the first egg." As if to still further substantiate this period, it will be noticed that the fifth and last egg in my case was deposited on May 30, and the chick appeared on June 23, again a period of just 24 days, as against Miss Turner's 25 days.

No pictures were taken of the young on the day they hatched, but on June 20 they were photographed when 3 days old, the pictures showing the 4 young with the one egg still unhatched. I did not visit them again until three days later (June 23), the day on which the fifth egg hatched, the pictures showing all 5 chicks in characteristic attitudes. Both on this, and previous visits, a constant hissing or buzzing noise was kept up, with snapping of the mandibles and various thrusts of the bill whenever I approached them. I again took pictures two days later (June 25), when 4 of the young were 8 days old, the youngest only 3 days old. It was a matter of great difficulty to obtain pictures of them at all, as just previous to my visit a heavy thunder shower had pretty well drenched them so that they presented a very forlorn appearance and were in no mood to be photographed. However, I set up the camera and had just managed to take one or two pictures showing the birds in an aggressive stage with mouths wide open and looking quite fierce when down came the rain again to add still further to my troubles. The youngest bird to my mind looked as though the time of its demise (the usual fate of the youngest) was not very far distant. This surmise was well founded, I think, for on again visiting the nest 3 days later (June 28), only 4 young could be found, these being 11 days old. Three of them immediately left the nest on my near approach and hid in the surrounding cattails. Fortunately, one for some reason or other preferred to remain in the nest and I was able to obtain some pictures showing it in characteristic attitudes. Time and again I managed to locate the other three in the surrounding herbage, but the instant I placed them in the nest they were out of it again before I could obtain any pictures. However, when my patience was nearly at an end, I did manage to get a picture showing the three of them in the nest together. The fifth young one either formed a meal for its stronger relatives, or was drowned, or perhaps eaten or carried away by its parent when cleaning up the nest. Speaking of sanitary arrangements at the nest, I have read some very disparaging accounts of this species in which the nest was in a dreadful state of filth, uneaten and smelling food lying about in all directions. This I am glad to say was not so in the present case, the nest on every one of my visits containing not a vestige of

Fig. 1. General view of nesting site of American Bittern.

Fig. 2. Nest and eggs of American Bittern

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uneaten food, the parent having cleaned up everything before leaving on a further hunting expedition. The empty egg shells, I may also remark, were removed from the nest upon the hatching of each chick, but apparently were not carried away to any great distance, as I found most of them on searching about in the immediate precincts of the nest. My last visit took place on July 2 when all the young had left the nest and could not be found anywhere in the neighborhood. They probably had left it a day or so earlier, making their stay in the home a period of about 14 days. The nest consisted of a platform 13 x 16 inches, composed of dry cattail leaves on top of a mound some 8 inches above the water level. At first it was somewhat exposed, but as the herbage commenced to grow it became more hidden and later made quite a pretty picture with its canopy of cattails overhanging it.

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WINTER LOSSES FROM STARVATION AND EXPOSURE OF WATERFOWL AND UPLAND GAME BIRDS IN OHIO AND OTHER NORTHERN STATES[1]

BY MILTON B. TRAUTMAN, WILLIAM E. BILLS AND EDWARD L. WICKLIFF

A CONSIDERABLE literature relative to winter losses of waterfowl and game birds in the northern United States has been accumulating during recent years. Believing that additional data concerning such losses is important to ornithologist and conservationist, we here cite instances of winter mortality in Ohio, and give brief accounts of losses in other northern States. Our data chiefly concerns sporting waterfowl and the Bob-white, and treat briefly the Ring-necked Pheasant and Ruffed Grouse. Observations in Ohio were made principally by us. Data on observations in other States were obtained from scientific publications, newspapers, sporting magazines, and from answers to questionnaire letters which were sent to responsible wildlife conservationists in 11 northern states.

WATERFOWL

The most striking winter loss of waterfowl in Ohio which has come to our attention took place in March of 1932. The highest death rate was at the western end of Lake Erie where there was present a large concentration of waterfowl.[2] Losses likewise occurred in such widely separated Ohio localities as Lake St. Marys in Auglaize and Mercer counties, Indian Lake in Logan County, and Buckeye Lake in Licking, Fairfield and Perry counties.

The winter of 1931-32 was unusually mild until March, there occurred only two snowfalls of consequence, and the longest freezing period of any moment lasted only 4 days. Partly because of the mildness of fall and winter, an unusually large number of waterfowl individuals and species remained in Ohio, and in several sections the wintering population seemed more than five times greater than during any of the preceding 10 winters. Apparently the large number of wintering waterfowl was partly the result of the enormous amount of baiting and feeding that was done in the fall of 1931, especially

[1] The writers wish to acknowledge indebtedness to Clarence C. Cottam, Paul L. Errington, Lawrence E. Hicks, Harry C. Oberholser, Earl C. O'Roke, R. E. Rebrassier, and Josselyn Van Tyne for their helpful criticisms and suggestions during the construction of this paper; also to Hilary J. Deason for assistance in the final preparation of the figures and tables.

[2] This waterfowl concentration also covered sections of the state of Michigan and province of Ontario adjacent to western Lake Erie. Winter losses also occurred in these sections.

in the marshes adjacent to Lake Erie.[3] Some estimate of the unusual waterfowl concentration can be obtained from Trautman's observations at Buckeye Lake. Throughout that season an average of slightly over 1,000 individuals, comprising 16 duck species and the Coot, were recorded. In other winters between 1921 and 1934 the duck population seldom exceeded 500 birds and usually fewer than 10 species. Reports by Dr. Harry C. Oberholser, Trautman, Wickliff, and others indicated that correspondingly large waterfowl numbers wintered on Lake Erie and adjacent marshes. The wintering flocks were greatly augmented by early transients during the latter part of February. This combination of a large wintering population and large transient invasion resulted in an unusually accentuated waterfowl population by March 1, 1932. Table 1 gives the waterfowl numbers recorded at a few Ohio localities in that month.

TABLE 1. SWANS, GEESE, DUCKS AND COOTS RECORDED AT BUCKEYE LAKE, LAKE ST. MARYS AND THE SANDUSKY MARSHES IN MARCH, 1932. (FIELD DATA OBTAINED BY TRAUTMAN, WICKLIFF, AND OBERHOLSER.)

COMMON AND SCIENTIFIC NAME	LOCALITY AND DATE					
	Buckeye Lake March 12	Lake St. Marys March 15	East Harbor March 18	Toledo to Port Clinton March 23	Bay Bridge March 24	East Harbor March 25
Whistling Swan, *Cygnus columbianus*	...	3	1	...	1	1
Canada Goose, *Branta canadensis*	...	600	...	...	...	...
Lesser Snow Goose, *Chen hyperborea*	...	2	...	...	...	...
Blue Goose, *Chen caerulescens*	...	1	...	...	...	...
Mallard, *Anas platyrhynchos platyrhynchos*	200	1,000	300	400	100	160
Black Duck, *Anas rubripes*	2,500	2,500	1,000	1,000	800	900
Pintail, *Anas acuta tzitzihoa*	300	1,000	2,000	500	1,500	1,500
Green-winged Teal, *Anas crecca carolinensis*	10	250	...	...	3	15
Blue-winged Teal, *Anas discors*	...	1	...	...	...	2
Shoveller, *Spatula clypeata*	...	10	...	20	25	30
Gadwall, *Chaulelasmus streperus*	3	3	800	15	150	200
Baldpate, *Mareca americana*	10	2	100	1,000	2,000	1,000
Wood Duck, *Aix sponsa*	...	1	...	...	...	...
Redhead, *Nyroca americana*	12	50	40	200	300	300
Ring-necked Duck, *Nyroca collaris*	100	250	250	200	2,500	800
Canvas-back, *Nyroca vallisineria*	...	2	500	700	400	500
Lesser Scaup, *Nyroca affinis*	25	50	50	200	100	100
American Golden-eye, *Bucephala clangula americana*	3	1	20	50	1	2
Buffle-head, *Bucephale albeola*	12	2	15	18	10	12
Old-squaw, *Clangula hyemalis*	...	1	...	...	...	...
Ruddy Duck, *Oxyura jamaicensis rubida*	2	2	...	...	...	...
Hooded Merganser, *Lophodytes cucullatus*	8	2	2	2	10	15
American Merganser, *Mergus merganser americanus*	10	50	150	200	170	100
Red-breasted Merganser, *Mergus serrator*	...	...	1	...	...	...
American Coot, *Fulica americana americana*	200	1	1,000	500	450	500
Total	3,395	5,784	6,229	5,005	8,520	6,137
Grand Total						35,070

[3] It is our belief that baiting and feeding practices sometimes interfere with the expression of the migratory instincts of waterfowl, causing many to delay their migration and ultimately to attempt to winter (Trautman, in press). Baiting of waterfowl has been recently prohibited by Federal regulations.

If March weather conditions had been normal the waterfowl would have suffered no undue hardships. Normal weather did not prevail, for on March 5 a prolonged cold period began. Some conception of general weather conditions are obtained from Figure 1. This figure indicates

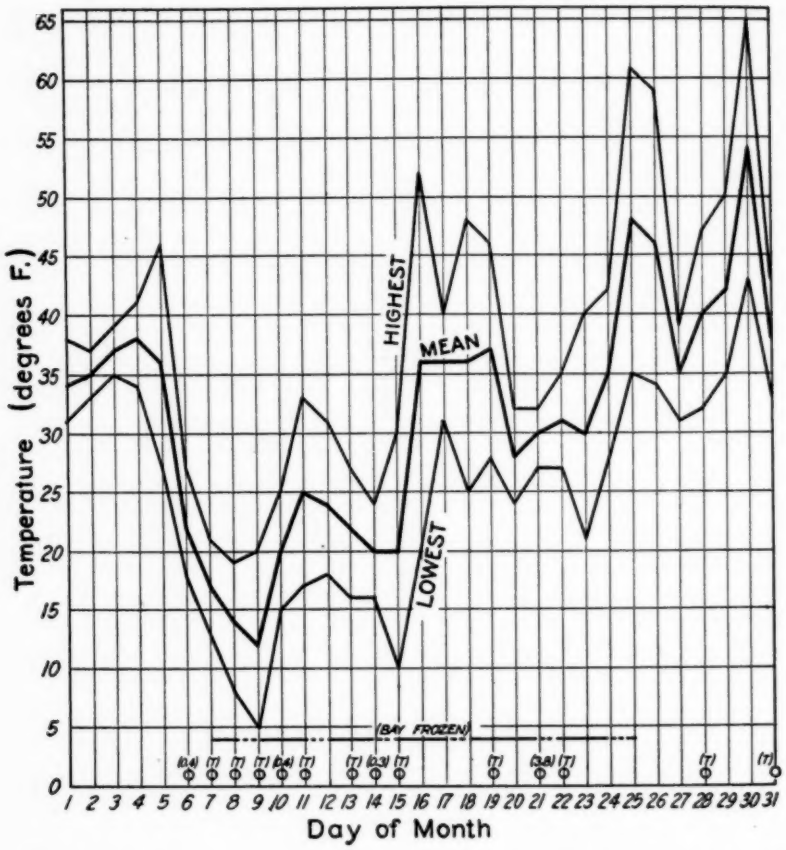

Fig. 1. Maximum, mean, and minimum temperature curves at Sandusky, Ohio, March, 1932. Snowfall is indicated in inches for 24 hour periods, and T indicates a trace. The period during which Sandusky Bay was frozen is shown by the broken line (Data from U.S. Weather Bureau).

that in the vicinity of the city of Sandusky the daily mean temperature dropped sharply from 36° F. on March 5 to 12° on March 9, and that temperatures averaging below freezing continued until March 15. On March 20 freezing temperature again prevailed and remained for the next 4 days, after which the mean temperature rose to higher levels. Sleet and snow fell generally throughout Ohio from March 6 to 10 and again, in larger quantities, on March 21-22. Sandusky Bay and adjacent waters were frozen from March 7 to 25, and the ice

reached a maximum thickness of 7 inches.[4] The inland lakes of Ohio were ice-covered from March 7 to 25, except for a few small holes.

On March 12, one week after the beginning of inclement weather, Trautman made his weekly investigation of the birds about Buckeye Lake. That day he found over 3,000 ducks, 200 Coots (see Table 1) and many other water birds huddled about a small, open hole at the ice-covered, western end of the lake. More than 200 ducks and over 150 Coots seemed too weak to fly. About 35 birds, all apparently dead, were lying on the ice. The dead birds identified were 5 Mallards, 6 Black Ducks, 4 Pintails, 3 Ring-necked Ducks and 8 Coots. The remainder could not be identified because they were lying out of reach on thin ice or frozen deeply in thicker ice. Gross examinations made by Trautman on 2 Mallards, 1 Black Duck, 2 Pintails, 1 Ring-necked Duck and 5 Coots showed no marked pathological lesions, no unusual amount of parasitism, and no mechanical injuries. The birds were greatly emaciated, and their alimentary tracts indicated no recent feeding. On the basis of this investigation and reports from elsewhere concerning waterfowl starvation William H. Reinhart, then Ohio Conservation Commissioner, issued a general order on March 14. The order directed that wherever possible, grain should be fed to all waterfowl in Ohio that were in obvious need of food.

Realizing the need for further investigations, Trautman and Wickliff began a survey of lakes in inland Ohio, and the waters and marshes adjacent to the western end of Lake Erie. March 15 was spent at Lake St. Marys, where all except a few individuals of the recorded 24 waterfowl species (see Table 1) were huddled about a small hole in the otherwise ice-covered lake. With few exceptions the birds seemed in relatively good condition, presumedly the result of having ready access to corn and other grains in nearby fields, and to additional grain which had been scattered over the ice for them by Ohio game protectors.

On March 18 Trautman and Wickliff investigated several Lake Erie marshes that are situated between the cities of Port Clinton and Sandusky. On this day Lake Erie, Sandusky Bay and adjacent waters were frozen over, except for a few, small open holes. Sleet, ice, and snow covered the fields and marshes, effectively sealing most of the "natural" food of waterfowl. The birds were seemingly in fair condition in those few marshes where large amounts of grain had been scattered for them while the storm was in progress, or where grain in a nearby field was available. Elsewhere the waterfowl were in a deplorable state, particularly in East Harbor marsh (Ottawa County). In this marsh were found about 900 living Coots, most of them too weak to fly. At least 400 of these were observed to leave the frozen waters to feed on the dried grass of lawns about cottages. More than 100 dead Coots and over 5,000 living and 88 dead ducks (see Table 1) were found. Identification of some of the dead ducks was impossible because they

[4] Letter from C. C. Cooper, October 15, 1935.

were frozen deeply in the ice or were lying on thin ice beside an open hole and hence unapproachable. From the dead birds identified we inferred that Black Ducks, Ring-necked Ducks and Canvas-backs comprised at least 65 per cent of the total, and Mallards, Gadwalls, Baldpates, Pintails, Redheads and Lesser Scaups the remainder. On March 25 we found an additional 29 dead ducks and 27 Coots, although we covered only about 20 per cent of the marsh.

From March 23 to 25 a reconnaissance party, consisting of Harry C. Oberholser and M. A. Charlton of the U.S. Biological Survey, the late Harry Crossley of the Ohio Division of Conservation, Trautman and Wickliff, investigated other marshes about Sandusky Bay and the western end of Lake Erie. During that period the snow was more than 3 inches deep and lakes and streams ice-covered, but general weather conditions had become rather favorable. It was apparent that the crisis had passed, since "natural" food was rapidly becoming available in large quantities. In addition the Ohio Division of Conservation, many hunting clubs and other organizations had begun the "artificial" feeding of waterfowl. Mortality among the birds had almost ceased and many of the survivors seemed to be rapidly recovering.

In our investigations about Lake Erie we found over 300 dead ducks and approximately the same number of dead Coots. We can give no accurate estimation of the total number of dead waterfowl but believe it was at least a thousand.

Examination of Dead Waterfowl

Of the 53 dead waterfowl which were saved for future examination, 20 Coots and 25 ducks of 8 species were sufficiently entire and preserved so that complete data were obtained. These birds were weighed in the field by Trautman and Wickliff. Upon returning to Columbus, Trautman made outlines of breast contours, and later he and Wickliff made gross laboratory examinations to ascertain the general condition of each bird. After the birds had remained in a formalin solution for almost three years, Bills completed the laboratory examinations.

The weights of the examined ducks and Coots are given in Figures 2 and 3 and in Table 2. Included in the figures are "normal weight" ranges for each species. These ranges are a composite of extreme weights which have been compiled from Forbush (1925: 196, 200, 206, 223, 232, 235, 241, 244), Phillips (1923: 68-9, 139, 189-90, 307-8; 1925: 122, 163-4, 183, 273), and Phillips and Lincoln (1930: 292-9).[5]

[5] Our experiences with waterfowl lead us to believe that these composite weights adequately cover the normal range for each species. We realize that the lower weight limit must be arbitrary since there is no sharp demarcation between thin and emaciated individuals.

In comparing these "normal weight" ranges with weighed birds now in the University of Michigan Museum of Zoology, it was found that all except a few of those ducks collected in late fall or early winter were *above* the average in weight for their species as shown by the "normal weight" range; those taken in spring were *below* the average in weight for their species. A few, normal-appearing, spring individuals were slightly beyond the lower end of the "normal weight" range.

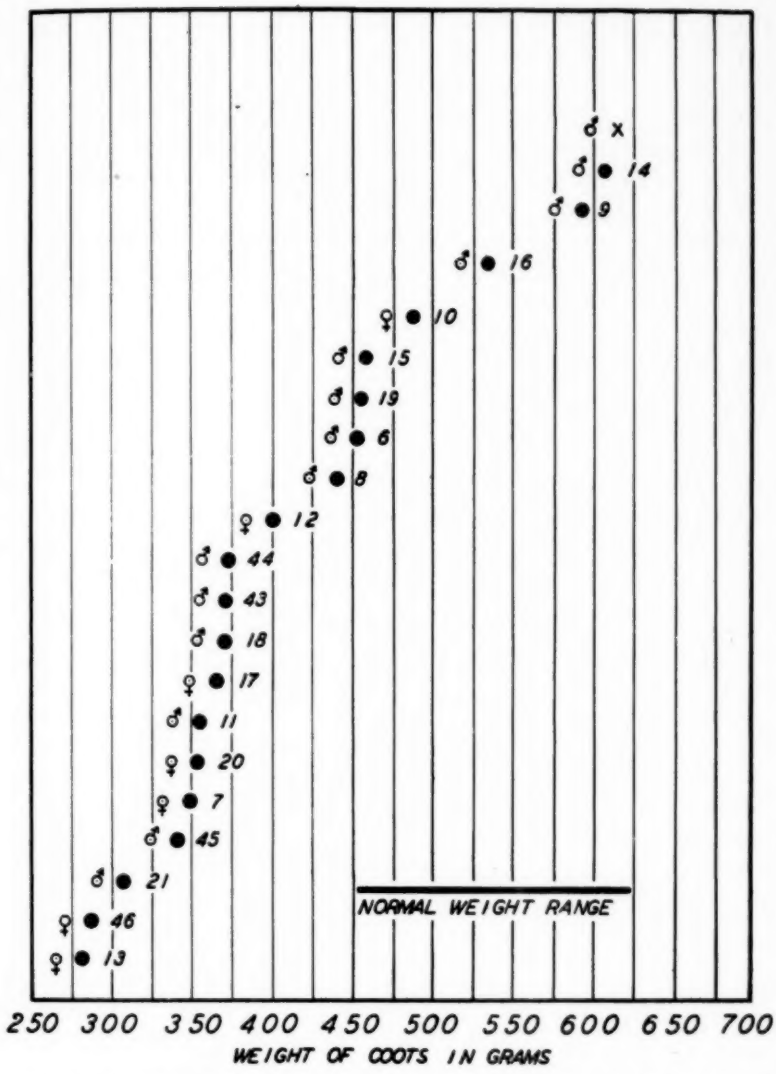

Fig. 2. Weights of Coots from Lake Erie marshes compared with the "normal weight" range for the species. Each dot represents an individual, and specimen number and sex are indicated. X designates the supposedly normal Coot collected at Buckeye Lake, April, 1932.

Also included in Figs. 2 and 3 are the weights of 2 apparently normal ducks and one Coot. These were collected by Trautman at Buckeye Lake on April 21, 1932, one month after the March stress period. The April birds weighed more than did those individuals of the same species found dead in March.

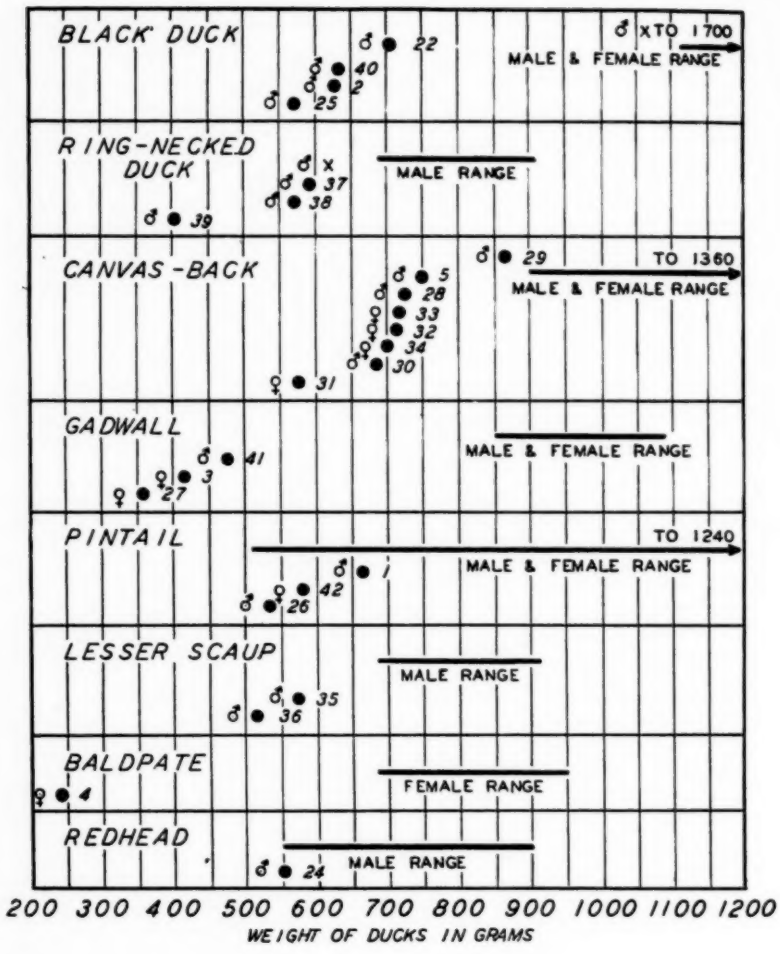

Fig. 3. Weights of March ducks from Lake Erie marshes compared with the "normal weight" range for the species. Each dot represents an individual, and specimen number and sex are indicated. X designates the supposedly normal ducks collected at Buckeye Lake, April, 1932. The extreme lower limit of the male and female ranges applies only to the females since that sex is the lightest in weight.

Figure 2 shows that the majority of the Coots are below the "normal weight" range. Examination disclosed that 3 contained moderate deposits of fat, 3 had slight amounts, and each of the remaining contained only a trace or no fat. Figure 3 shows that, except for the Pintails and Redhead, the March ducks are beyond the lower limit of the "normal weight" range. Figures 4 to 8 show breast contours of Coots and of 5

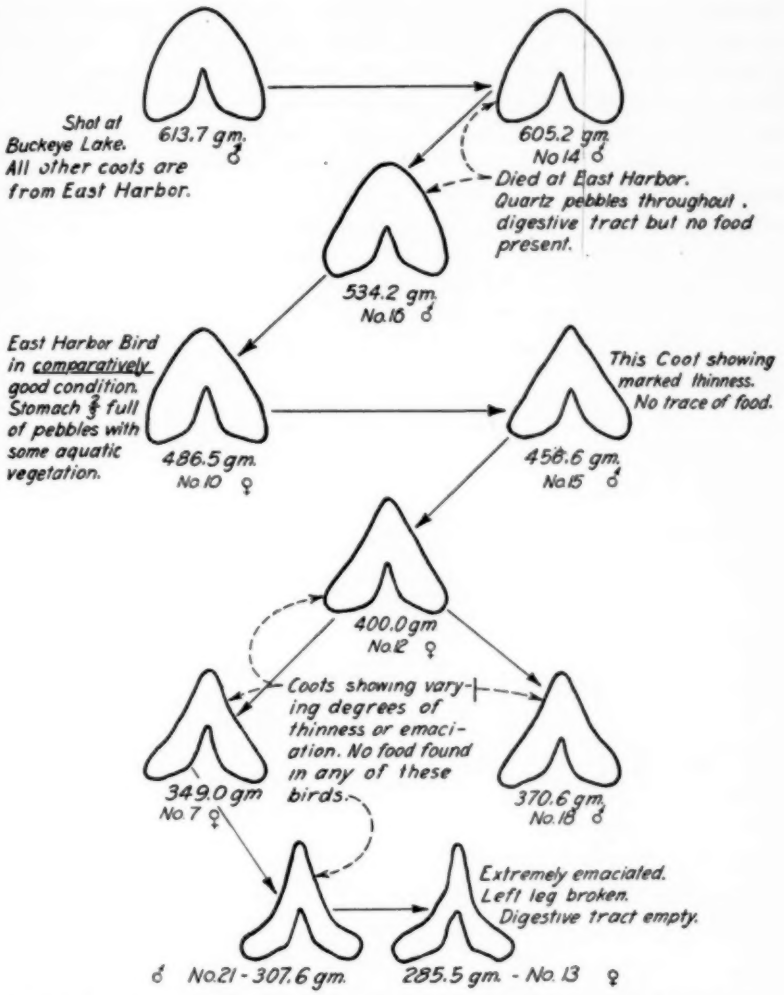
Shot at Buckeye Lake. All other coots are from East Harbor.
613.7 gm. ♂
605.2 gm. No 14 ♂
Died at East Harbor. Quartz pebbles throughout digestive tract but no food present.
534.2 gm. No.16 ♂
East Harbor Bird in comparatively good condition. Stomach ¾ full of pebbles with some aquatic vegetation.
486.5 gm. No.10 ♀
This Coot showing marked thinness. No trace of food.
458.6 gm. No.15 ♂
400.0 gm No.12 ♀
Coots showing varying degrees of thinness or emaciation. No food found in any of these birds.
349.0 gm No.7 ♀
370.6 gm. No.18 ♂
Extremely emaciated. Left leg broken. Digestive tract empty.
♂ No.21 - 307.6 gm.
285.5 gm. - No. 13 ♀

Fig. 4. Diagrams of breast contours of Coots in relation to their weights.

duck species,[6] collected at East Harbor; also contours of the seemingly normal birds from Buckeye Lake. The contours show a direct correlation between amount of fat and general physical condition and weight, since the fullest contours are from the heaviest birds, and vice versa. Obviously, the most emaciated birds had oxidized and used all of their reserve fat and almost all muscle tissue before succumbing.

Examination of the 45 birds revealed food in the crop and gizzard of one Coot and 8 ducks. The amount of food per bird was small, and

[6] Not all of the breast contours have been included, but the extreme weight range is covered. This method of showing relative condition has been previously used by Errington (Leopold, 1933: fig. 25, opp. 262).

consisted of the stolons, leaves, and stem portions of aquatic plants, material that probably was grass, a few gastropods and a few larvae of aquatic insects. Coots No. 44 and 46 had eaten feathers, some of which were attached to skin. Several Coots had varying amounts of undigested grain in their intestinal tract, suggesting the possibility that they had died after "natural" or "artificial" food became available, and that apparently they had been by that time too weak to make a recovery. Alimentary tracts of all birds contained grit, which consisted mostly of quartz pebbles. The amount was usually small, since less than 12 pebbles were found in most tracts. Sand was present, especially in the intestines, and occurred in larger amounts than did grit. The Coot intestines contained on the average more grit than did those of the ducks.

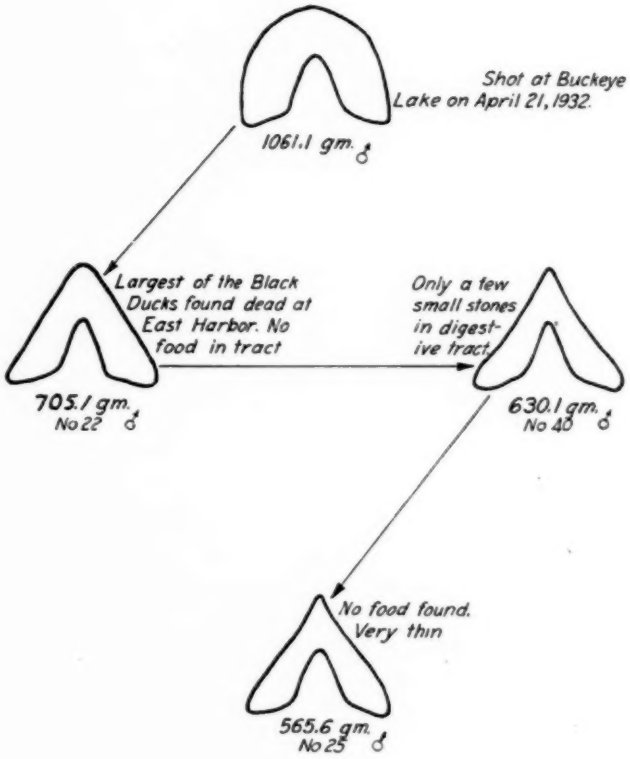
Shot at Buckeye Lake on April 21, 1932.
1061.1 gm. ♂
Largest of the Black Ducks found dead at East Harbor. No food in tract
Only a few small stones in digestive tract.
705.1 gm. No 22 ♂
630.1 gm. No 40 ♂
No food found. Very thin
565.6 gm. No 25 ♂

Fig. 5. Diagrams of breast contours of Black Ducks in relation to their weights.

TABLE 2. AMOUNT OF PARASITIC INFESTATION IN FORTY-FIVE DUCKS AND COOTS WHICH DIED IN THE LAKE ERIE MARSHES OF OHIO DURING MARCH, 1932.[1]

Specimen No.	Common Name	Sex	Weight in Grams	Nematoda	Acanthocephala	Cestoda	Trematoda[2]	Protozoa (Coccidia)	Remarks
14	Coot	M	605.2	N	N	N	N	N	
9	Coot	M	592.4	N	N	N	N	N	
16	Coot	M	534.2	N	N	N	N	N	
10	Coot	F	486.5	N	N	N	N	N	
15	Coot	M	456.6	N	N	N	N	N	
19	Coot	M	454.7	N	N	N	N	N	
6	Coot	M	452.9	N	N	N	N	N	Lead shot
8	Coot	M	439.9	N	N	N	N	N	
12	Coot	F	400.0	N	N	N	N	N	Severe enteritis
44	Coot	M	372.9	N	N	N	N	N	Lead shot
43	Coot	M	371.2	N	N	N	N	N	
18	Coot	M	370.6	N	N	N	N	N	
17	Coot	F	365.3	N	N	P1	N	N	
11	Coot	M	357.0	N	N	N	N	N	
20	Coot	F	353.6	N	N	P1	N	N	
7	Coot	F	349.0	N	N	N	N	N	Severe enteritis
45	Coot	M	340.9	N	N	N	N	N	
21	Coot	M	307.6	N	N	N	N	N	
13	Coot	F	285.5	N	N	N	N	N	Left leg fractured
46	Coot	F	282.9	N	N	N	N	N	Abdominal abscesses
22	Black Duck	M	705.1	N	N	N	N	N	Lead shot
40	Black Duck	M	630.1	N	N	P2	4L	N	
2	Black Duck	M	624.5	N	P3-S-L	P1	3C	N	
25	Black Duck	M	565.6	N	N	P1	N	PS	
37	Ring-Neck	M	591.2	N	N	P1	5S	N	Large liver abscess
38	Ring-neck	M	573.3	N	N	N	N	N	
39	Ring-neck	M	405.7	N	P1-S	P1	N	N	
29	Canvas-back	M	867.6	N	P1-S	P1	N	N	
5	Canvas-back	M	750.2	N	P1-S-L	P2	10 C-5S	N	
28	Canvas-back	M	722.6	N	N	P2	N	N	
33	Canvas-back	F	718.7	N	P2-S	P3	6L	N	
32	Canvas-back	F	714.3	N	N	P1	N	N	
34	Canvas-back	F	700.1	N	P3-S-L	P1	3L	N	
30	Canvas-back	M	685.1	N	N	P1	N	N	
31	Canvas-back	F	574.8	N	P1-S	P1	N	N	Lead shot
41	Gadwall	M	477.7	N	N	P1	N	N	
3	Gadwall	F	414.1	..	..	...	..	N	Intestinal tract missing
27	Gadwall	F	359.9	N	N	P2	N	N	
1	Pintail	M	663.8	N	N	N	N	N	
42	Pintail	F	580.1	N	N	N	N	N	
26	Pintail	M	533.6	N	N	P2	N	N	Lead shot
35	Lesser Scaup	M	570.3	N	N	N	N	N	
36	Lesser Scaup	M	513.1	N	N	N	N	N	
4	Baldpate	F	240.4	N	N	N	N	N	
24	Redhead	M	552.7	N	N	N	N	N	

[1] N, no infestation; P1, light, P2, medium, P3, heavy infestation; S, small intestine; L, large intestine; C, caeca; M, male; F, female.
[2] Figures indicate number of trematodes found.

Pathological examinations (see Table 2) of the bird carcasses by Bills revealed a fractured limb, embedded shot, and abscessed areas in a Coot and a duck, and indications of severe enteritis in 2 Coots. One to 17 lead shot were counted in the gizzard of 4 ducks, and additional shot were found in the intestines of 3 other ducks and 2 Coots. The intestinal tracts of all except a few birds were contracted, giving a shrunken appearance, but except for the 2 Coots with enteritis, no lesions of marked significance were found. All examined tissues showed a minimum of post mortem changes as a result of their frozen condition when collected and later preservation in formalin.

As shown in Table 2, 18 of the 20 Coots examined, or 90 per cent,

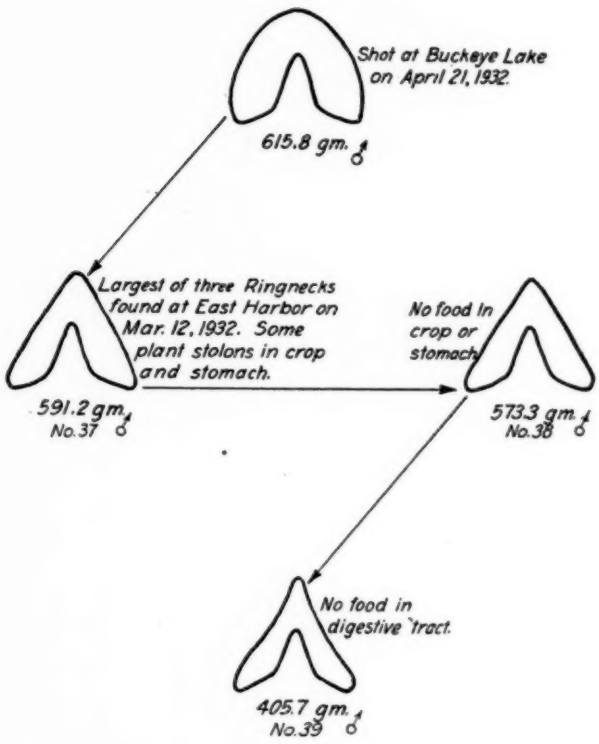

Fig. 6. Diagrams of breast contours of Ring-necked Ducks in relation to their weights.

disclosed no parasitism. Two parasitised birds contained light infestations of tapeworms (Cestoda). Sixteen of the 25 ducks, or 65 per cent, contained intestinal parasites, of which 4 ducks were very heavily infested. The parasites were indentified to class and the numbers counted or estimated. Tapeworms were found in every positive duck, thorny-headed worms (Acanthocephala) were found in 7 ducks, or 28 per cent, and flukes (Trematoda) in 6 ducks, or 24 per cent. No round worms (Nematoda) were found in Coots or ducks. Coccidia oocysts were observed in one duck, and no pathological changes resulting from heavy coccidia concentrations were noted. Negative results were obtained from examinations of the gizzard, heart, trachea, eye and other organs. Muscle tissue was not carefully examined for parasites.

Our evidence concerning amount of injury, disease, parasitism, or pathological condition caused by shot does not appear to be sufficiently great to warrant the conclusion that these factors were the sole cause of death. However, our examinations could not be conducted under optimum conditions, which may have caused the above-mentioned factors

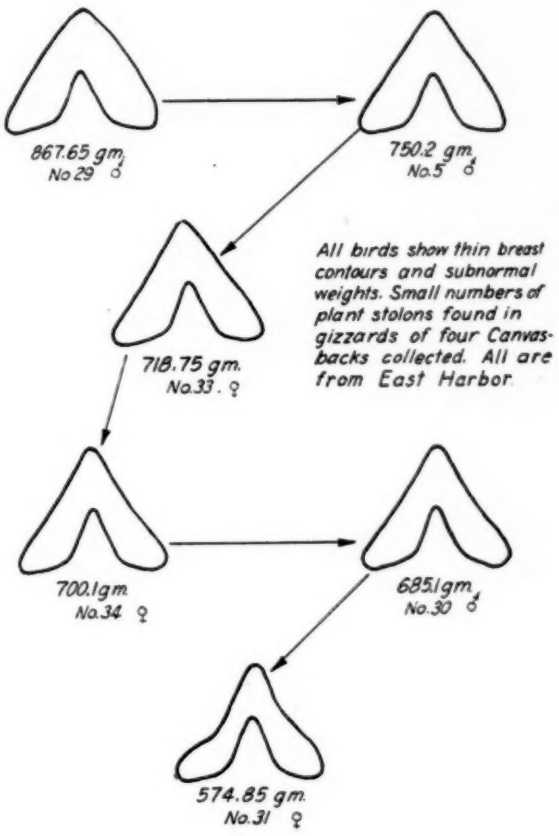

Fig. 7. Diagrams of breast contours of Canvas-back Ducks in relation to their weights.

to appear less important than they in reality were. As examples: the most satisfactory examinations for blood protozoa and microfilaria require blood smears from living birds or specimens recently dead. Our specimens were long dead. The finding of so few coccidia immediately suggests failure to discover the majority of protozoa or bacteria present. Recently dissolved shot may have been a greater detrimental factor than suspected. Lastly, the birds may have recently recovered from some parasitic or bacteriological infestation which displayed no visible trace but which left the birds in a weakened condition.

Granting that injury, disease, etc., were factors in the death of some of these waterfowl it is apparent to us that starvation and exposure played a part, and particularly with those birds whose reserve energy of fat and muscle tissue was almost entirely utilized. Such individuals

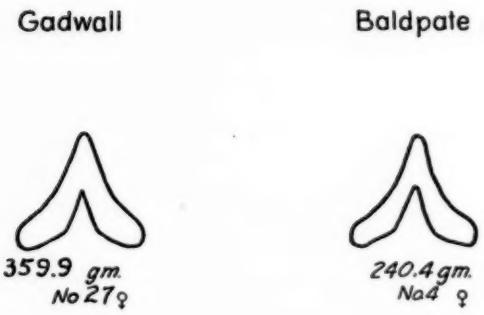

Fig. 8. Diagrams of breast contours of Gadwall and Baldpate ducks in relation to their weights. These individuals, collected at East Harbor, were extremely emaciated.

were obviously too weak to have survived under natural conditions. From his experiments upon captive quail, Errington (1939:25-6) believes that 50 per cent of the full weight of an individual Bob-white represents very nearly the minimum level from which recovery under the best of circumstances is possible. Our most emaciated waterfowl were more than 50 per cent below compiled "normal weight" range. The questions now arise: what about those waterfowl which were only slightly below or within the "normal weight" range and which contained some fat and considerable muscle tissue? Did injury, disease, ice formation over eyes and in bills and nostrils cause their death, or was starvation a contributing or major factor? Leopold (1937:410) has shown that well-conditioned, healthy Bob-whites with alimentary tracts filled with food will succumb to low temperatures and adverse conditions. In a personal communication Dr. Hicks informs us that he found Bob-whites in Ohio "frozen in a huddled lump with their crops full or nearly full of corn and other high grade foods." Kendeigh (1934:315-17) experimented with English Sparrows (*Passer domesticus*) that were kept in darkness without food, and found that the survival time was shorter, the total percentage of initial weight lost before death was less, and the weight at death was higher with those sparrows subjected to temperatures below zero F. than with those kept in average temperatures somewhere between zero and 102.3°F. All of this evidence substantiates the assumption that bird species and individuals have a threshold of tolerance to cold. Below this threshold a well-conditioned individual will succumb because it cannot oxidize body tissue fast enough to keep itself alive. Obviously the threshold of cold tolerance differs greatly among the many groups and species of birds, and probably between individuals of a species. Such variation in tolerance to cold may explain why many Coots in comparatively good flesh died at East Harbor, and why the

hardy Black Ducks, which normally winter in a colder climate, died only after almost all of their body tissue had been utilized.

Whatever the causes of death, our field experiences with waterfowl in 1932 and in other years, have convinced us that proper, "artificial" feeding during the average stress periods will save some of the waterfowl from death, and will usually reduce mortality to a culling of crippled, diseased, parasitised, or greatly emaciated birds.

To demonstrate that waterfowl mortality during winter stress periods is not unusual we cite a few recent occurrences. In the New York City region during late February of 1934, 200,000 ducks were reported to have been in danger of starvation (Pearson, 1934:143). Prompt feeding of several tons of grain was believed to have prevented a large loss of birds. Dr. Gardiner Bump (*in litt.*, October 24, 1935) of the New York Conservation Department stated that although pathological examinations of ducks found dead in New York waters during March of 1934 revealed parasitism in many, mortality was attributed mainly to exposure too severe for weakened and emaciated birds to endure. Dr. Oberholser (1934:181-2) records the feeding of ducks along the Potomac River in January of 1934, and states that such feeding did much to prevent starvation.

In February of 1936, Gromme (1936:324-5) recorded the death "of hundreds and probably thousands of winter ducks" on Lake Michigan near Milwaukee, Wisconsin. The freezing of the surface water of the lake caused a food shortage, resulting in death by starvation, or the freezing of the weaker birds in the ice. Many of the examined ducks were found to be extremely emaciated and their digestive tracts were empty of food.

Bob-white

Published records of Bob-white (*Colinus virginianus virginianus*) mortality in Ohio from starvation and exposure to low temperatures and adverse conditions are surprisingly few. Kendeigh (1933:9-13) gives the most complete published account of such mortality when he discusses reasons for fluctuation in seasonal abundance of Bob-white. In the years from 1930-4, Trautman gathered considerable evidence of annual winter mortality of Bob-white in Ohio.[7] Since little of his investigations have been published, and published records of winter mortality from Ohio are comparatively few, the following conclusions and an instance of winter mortality are here given:

The investigation indicated that: (1) inability to obtain sufficient food during the stress periods of winter was often an important factor in reducing the Bob-white breeding population in Ohio, (2) some mortality from starvation and exposure occurred every winter, (3) in freezing weather following severe sleet storms, or during heavy snows

[7] The accumulation of much of this evidence was made while Trautman was associated with the Ohio Division of Conservation.

a high mortality among Bob-whites took place, (4) the heaviest mortality occurred on modern, "clean" farms where cover was deficient, and (5) during the most severe storms the death of Bob-whites from starvation and exposure occurred on farms where normally the cover and food was abundant (Trautman, 1935:18-20).

One of the best examples of winter mortality was observed in December of 1932. In the autumn of that year 3 coveys of Bob-whites on a farm in southern Paris Township, Union County, Ohio, were under weekly observations. The fall weather had been mild until December 10, and the birds comprising the 3 coveys seemed to be in excellent condition. On December 10, sleet and 3 inches of snow fell, and was followed by 3 inches more on December 13. With the falling of the first snow the temperature declined sharply and remained low until December 16 when it reached a minimum of 4 degrees below zero, F. On December 16, while conducting his weekly examination, Trautman found that 2 of the coveys, of 18 and 28 individuals each, were in apparently good condition. These Bob-whites were wintering in fields containing corn in shocks and the birds were feeding upon the corn. The birds in the third covey, an unusually large one of 32 individuals, were faring badly because they remained in a wheat-stubble field where their previously abundant food supply, of the achenes of the rag-weed (*Ambrosia elatior*), was covered by crusted snow. When found at 2:15 P.M., the living birds of this covey were huddled in a roughly-shaped circle in a brushy fence corner. Six were too weak to fly, 15 could fly less than 50 feet at a time, 5 flew well, and 5 were missing. The remaining bird was found dead. An autopsy of this adult male disclosed that it had a normal wing measurement (108 mm.) was not unduly parasitised, contained no injury or lesions attributable to disease, and weighed only 82.25 grams.[8] Partly because of the scattering of food for the living birds of this covey, 28 were alive on January 1, 1933.

A review of the literature not chiefly pertaining to Ohio indicates that: (1) Bob-white is especially susceptible to starvation and exposure during low temperatures, (2) references to winter mortality before 1910 are comparatively few and are generally vague, and (3) since 1910 a greater amount of literature has been produced. The primary reason for a larger literature production is the recent, marked increase in more thorough scientific work. However, it is possible that some of the increase in literary output is the result of an actual increase in extent and number of winter mortalities. Anyone who has studied the changing farming practices in the North-Central States during the past 50-year period realizes that the modern tendency of brush and weed removal and general "cleaning up" of farms has resulted in less favorable wintering conditions for Bob-white (Trautman, 1935:18-20).

[8] Fourteen Bob-whites, collected in central Ohio during December, had an average weight of 192.00 grams.

The earlier references to winter mortality from starvation and exposure generally consist of simple statements about destruction of great numbers of birds by deep and crusted snows (Judd, 1903:202 and 1905:18; Forbush, 1912: 370-3). The recent references are often very detailed, and contrast sharply in this respect with earlier ones. Several publications by Errington (1933a:11; 1933b:130-1; 1933c:32; 1933d:44; 1934:112-14; 1935:46; 1939: 22-7), and one by Errington and Hamerstrom (1936:366-72) cite specific instances of Bob-white mortality from adverse weather conditions in Iowa and Wisconsin. Scott (1937:21-7) gives conclusive evidence of reasonably strong Bob-whites in Iowa having been imprisoned and killed by drifting snow and other individuals having met death by exposure to severe weather. Green and Beed (1936:90-2) give definite evidence of a high mortality of Bob-white from starvation and hunger during "Iowa's most severe winter in 117 years [the 1935-36 winter]." Leopold (1937:408-16) presents excellent data on a heavy winter killing in Wisconsin, records (Leopold ,1933:77-8) the adverse effects of sleet storms upon Bob-white in Missouri, and (Leopold, 1931:79 and 1933:349) indicates that starvation and exposure losses take place in all North-Central States. A letter from H. W. MacKenzie (April 8, 1936) states that some Bob-white mortality from adverse weather conditions occur every winter in Wisconsin. Gardiner Bump (*in litt.*, October 24, 1935) recorded the death of Bob-whites in New York from starvation and exposure, as did Harry D. Ruhl (*in litt.*, April 15, 1936) for Michigan.

Ring-necked Pheasant

There appears to be no published record of pheasants (*Phasianus colchicus torquatus*) in Ohio dying from starvation or exposure to low temperatures. During the extremely cold winter of 1935-6 Dr. Hicks[9] observed pheasant mortality from starvation and exposure that was somewhat similar to that observed by Green and Beed (1936:83-4) in Iowa, but which involved the death of only a few "hens and wounded cock birds whose vitality was probably below par" (*in litt.*, March 4, 1939). Apparently such mortality can be expected in Ohio, since losses from adverse weather conditions have been observed in other northern States. Green and Beed (1936:84) record the death in Iowa, during the severe 1935-6 winter, of 250 birds of an original 400. Of the 250 individuals, 131 froze to death or died by choking from ice accumulations in nostrils and bills, 37 were snowed under, 13 died of pneumonia, and one died of starvation. The remainder died from other causes not directly attributable to severe weather conditions. A heavy pheasant loss from starvation and exposure is recorded by Beed (1938:509). He estimated the loss in the Waubay Refuge, Day County, South Dakota at 80 per cent of the population.

[9] Dr. Hicks has been conducting intensive studies of the pheasant in Ohio for several years.

Examination of 126 pheasant stomachs showed that 104 contained no food, and the remaining ones had only small amounts. Bump (1937:58) recorded the death from starvation of 39 pheasants in New York during the severe 1935-6 winter.

The comparative scarcity of authentic records for all northern States seemingly indicate that the species can withstand all except the most severe conditions. Errington (1939) has experimentally shown that pheasants can better retard or endure starvation than can Bob-white and can more quickly recover after a temporary food crisis.

Ruffed Grouse

The comparative lack of evidence of winter killing of Ruffed Grouse (*Bonasa unbellus*) through starvation and exposure, indicates that such mortality must be rare. There appears to be no published record of winter killing of grouse in Ohio. According to Dr. Bump (*in litt.*, October 24, 1935), no case of actual starvation was found in New York by 1936, although a large number of birds had received pathological examinations. Dr. E. C. O'Roke tells us that he has seen no evidence of death from starvation in approximately 120 Michigan grouse that have been brought in to him for pathological examination. Leopold (1933:349-50) gives no specific instance of winter mortality but states that grouse-killing winters are much less frequent in occurrence than are winters which kill Bob-white, because starvation of grouse is averted by budding. He likewise states that winter losses occur from a "special form of imprisonment" in which the grouse dive into the snow and are caught by an encrustation of sleet or ice on the surface. King (1937:531) states that a "2 day ice storm once in 5 years can do away with all of the increase built up during that period." He gives no specific instance of its occurrence.

From the writings of Leopold (1931 and 1933) and King (1937) we gather that as long as grouse have sufficient suitable snow in which to remain at night or during low temperatures, winter losses of this budding species from imprisonment, exposure, or starvation will be very low. It is only when deep snows become encrusted with sleet or ice, or there is ice without deep snow, that winter losses from adverse weather conditions may occur. Even then death is generally not caused by starvation or exposure to low temperatures, but by imprisonment of grouse beneath encrusted ice, or by their having been forced to roost in trees or on the ice-covered ground where they become the prey of predators.

Conclusions

Winter mortality of waterfowl and some species of upland game birds, caused by starvation, exposure to low temperatures, or a com-

bination of both, occurs in widely scattered localities in the northern United States.

Such mortality generally takes place during or immediately following severe sleet or snow storms when low temperatures freeze the surface water shutting off the usual food supply.

During the average stress period apparently only those birds die which are weakened by disease, parasitism, lead poisoning, mechanical injury such as are made by gunshot wounds, or ice formation over eyes, in bill and nostrils.

In extreme stress periods, and especially when the accumulated, adverse effects of winter are most pronounced, mortality of normal birds may occur from starvation and exposure.

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A STUDY OF WISCONSIN PRAIRIE CHICKEN AND SHARP-TAILED GROUSE

BY F. N. HAMERSTROM, JR.

THE Central Wisconsin Game Project, Necedah,[1] is a hundred thousand acres of sand and peat. Lumbered off in the '50's, it has been drained, burned, farmed, abandoned, and is now being developed for wildlife.

Original conditions have been completely changed. Widespread marshes and timbered swamps once dominated the landscape; they were drained and chopped out. Fires ate out the peat. Bluejoint and willow, or aspen where the peat was burned, now hold the old marsh beds. White and red pine once grew on the better soils of the intervening sand ridges and islands, jack pine and scrub oak on the poorer. The saw mill has claimed the good timber, fires destroyed the leaf litter which grew it, jack pine and scrub oak have taken its place. The old lumber holdings were drained and cut up into farms. Poor soil, unseasonable frosts, and drainage taxes drove out all but the hardiest farmers and now they have been bought out by the federal government. The hard-won fields are slowly disappearing, and government dams are restoring some of the lost water.

As the country has been changed, so have the fortunes of its wildlife. Originally there were no Prairie Chicken [2] (*Tympanuchus cupido americanus*) and but few Sharp-tailed Grouse (*Pedioecetes phasianellus campestris*). Evicted from their range to the south, Prairie Chicken came into the newly cleared land of the first farmers. The combination of large blocks of open wild land and few scattered farms was to their liking. They throve, and for thirty years the central counties were the best Prairie Chicken country in the Middle West. Fires in the drained peat, however, have changed thousands of acres of open marsh into thickly seeded aspen flats. On the heels of the 1930 drought, in particular, fire-sown aspen came in with a rush. As a result of the increase in brush there were three or four times as many Sharp-tails as Prairie Chicken in 1936, and each year the disparity grows larger and larger.

These two grouse are the most important species of wildlife on the Project. As yet little is known about their management. With a million dollars to spend in developing the area for wildlife, it seemed wise to find out what wildlife needed. A research program was begun in January, 1936, and abandoned in August, 1937. The work done on other

[1] Project LD-WI-5, Farm Security Administration, Region II; Mr. W. T. Cox, Regional Forest-Biologist. Acknowledgments—field assistance: James Blake, Burns Carter, J. R. Goodlad, Victor Litzenberg, Oswald Mattson, William Sommerville, and Millard Truax, members of the Project game staff; Frances Hamerstrom, Wallace Grange, Cleveland Grant, and Wayne Truax.

[2] Both pinnated and sharp-tailed grouse are often popularly called "Prairie Chicken"; in this paper however, "Prairie Chicken" is used in the strict sense to refer only to pinnated grouse.

species, and a description of methods of trapping Prairie Chicken and Sharp-tails (Hamerstrom and Truax, 1938), have been reported.

Population Density

On the grey silt loams of Illinois, where there are no Sharp-tails, Yeatter (1937) has found a late summer average of one Prairie Chicken per 13-16 acres. Leopold (1931) places the average population of both grouse together at one per 40 acres in the Wisconsin sand plain. On the best of this range and at the high of the cycle the figure rises to about one grouse per 10 acres. My work dealt with a population just past the cyclic low and on a badly damaged range; I estimated it at one grouse per 85-100 acres during the winter of 1936-37, with about three Sharp-tails to every Prairie Chicken.

Booming Behavior of Prairie Chicken

In 1937 we found 23 booming grounds on the Project, or about one per 4500 acres. I think we found practically all of them.

It is generally assumed that the same booming grounds are used year after year. I do not have complete data, but at least 11 were used in both 1936 and 1937, at least 13 in 1937 and 1938, at least 7 in all three years, and one has been known to have been used for at least six years. On the other hand, four which were regularly used in 1936 were not in 1937, and at least one 1937 booming ground was not reoccupied in 1938. One spot, to which a cock or two had occasionally come to boom in 1937, became a regularly used booming ground in 1938.

All but two booming grounds were in herbaceous cover in open places from 3 to 300 acres in size. Nineteen were in mixed grasses, sedges, and forbs, 6 in stubble or weedy fallow fields, 2 in grass and scattered willows. Low knolls were chosen for 10, 12 were level, 5 were in marshes and were covered wtih a half inch of water after each spring rain. Cocks continued to boom on these flooded grounds.

Each booming ground was used apparently by a definite number of cocks. Eighteen was the largest number and 3 the smallest, with 8 or 9 on most. During early spring cocks boomed and fought over the whole booming ground, as shown by the trampling of all the old vegetation. Late in the main part of the season, however, only certain plainly marked parts were used, as shown by trails in the new grass. These trails (see figure 1) were made by stamping and running; bowing and turning places were indicated by circular enlargements. It appears that the early season is spent in general fighting, each cock trying to cut out a place for himself. Once the boundaries have been set there is much less fighting, the cocks tending to remain in their respective trails. Something equivalent to "peck dominance" is clearly involved. Whether each individual stayed in the same trail all season was not determined, but awaits a study of marked birds.

One cock was seen booming at the top of a small fire-killed oak at the edge of a booming ground. Leonard Wing has told me of a Wisconsin Prairie Chicken which he saw booming in the top of a young jack pine only 30 inches tall; Gross (1929) reports a Heath Hen (*T. c. cupido*) booming in an oak. The European Birkhahn (*Lyrurus tetrix*), of course, often booms in trees.

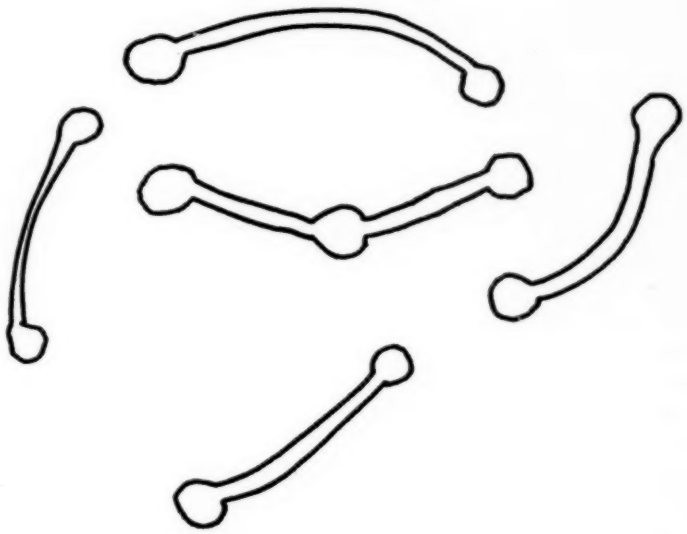

Figure 1. Diagrammatic drawing of late-season trails on a small booming ground of the Prairie Chicken

The mating display was not confined to regularly used booming grounds. What may be called "casual booming" was often seen, a few cocks booming at places which were not used regularly, perhaps only once. A wide variety of cover types, including food patches, open oak woods, blueberry knolls, and open grass meadows, were used for casual booming. Whether the birds so engaged had been unable to hold a place on a booming ground and so had to put on a private show, or whether chance meetings brought about these displays, are still moot questions. The casual booming on the food patches in early spring suggests the latter explanation.

The main part of the booming period fell between early April and early June, although first and last records embrace a much wider span.

The earliest mating displays were seen during thaws on February 25, 1936, and February 5, 1938. On both occasions cocks were strutting on snow covered ground, going through the usual motions with pinnae, wings, and tail, but not making the booming sound. The complete performance was first reported in 1936 on March 21, in 1937 on

March 13 and in 1938 on March 2. Affected by the weather, March booming was sporadic, vigorous for several days at a time, with little or none on other days.

Like the breeding display of the domestic chicken (see Pezard, 1920; Hamilton, 1938), booming is probably influenced by internal secretions of the testes. But what activates the process? Bissonnette (1938) summarizing a large volume of experimental work, has concluded that light, not temperature, activates the gonads of a number of birds and mammals, but also points out that not all species are sexually photoperiodic. Nice (1937) has shown that the start of egg laying in the Song Sparrows she studied was correlated with temperature and not with light, and quotes other authors to show that still other factors influence the start of laying in other species. Without denying the possibility that even in these cases light may have an important function in pre-conditioning the gonads, it is plain that factors other than light may influence the translation of physiologic readiness to actual breeding.

The field observations of Marshall and Jensen (1937) have shown that the dancing of the Columbian Sharp-tail (*P. p. columbianus*) is correlated with light conditions. My own field work leads me to believe that the booming of Prairie Chicken is regulated by the joint action of light and temperature.

That the light-temperature effect lies between upper and lower limits, and does not operate through a lower threshold only, is suggested by: (a) late winter displays occurred on days warmer than usual, (b) early spring displays occurred for an hour or two after sunrise on clear bright mornings with temperatures a few degrees below freezing, but not on raw cloudy mornings which were five or six degrees warmer, (c) during the early part of the main booming season booming occurred all day on cloudy days; later, in warmer weather, cloudy days did not produce the day-long response, (d) during the height of the season booming occurred from the first faint trace of light until an hour or two after sun-up, again for about two hours before dark; there was less activity on unusually hot days than on moderate ones, (e) on those hot days and toward the end of the season generally, there was more activity in the cooler early morning than in the evening, and morning booming stopped earlier than usual, (f) at the end of the season, although cocks continued to come to their regular stations morning and evening, booming was heard only on occasional clear frosty mornings and stopped as soon as the air grew warmer shortly after sunrise.

Light rains did not deter booming cocks, heavy rains silenced them completely. Birds were once seen booming in a late spring snowstorm.

The season ended even more gradually than it began. Long after the last scattered booming of the main season had stopped, some of the booming grounds were still used as meeting places. In early July the

trails made well-marked alleys in the tall grass on some of the grounds; at a few the cocks were seen at their regular stations until even later, on one in particular in September, 1937. Desultory booming was heard on three mornings in mid-October, 1938, and one farmer reported that booming is regularly heard again for a short time, after the late summer silence, after the first hard frost of autumn. Several of the booming grounds were not wholly abandoned during the winter: to these, even while the ground was covered with snow, Prairie Chicken sometimes came to loaf.

It seems that in the behavior pattern of Prairie Chicken there is, in some cases at least, a carry-over of some connection with the booming ground well beyond the main booming period. As already pointed out, the beginnings of the display were seen in February. There may have been earlier ones. Where, then, does one season stop and the next begin?

There is a close parallel between the booming of Prairie Chicken and of the Heath Hen, as reported by Gross (1928), particularly in respect to the extent of the main seasons, times of day during which booming occurs, and the effect of weather on the performance.

Dancing Behavior of Sharp-tails

Although Sharp-tails greatly outnumbered Prairie Chicken during the winter, only seven dancing grounds were found. An eighth, found by Franklin Schmidt about 1929 and still in use, was also visited. At least two were used in both 1937 and 1938; a third, Schmidt's, was known to have been used for at least five years (1929, 1934, 1935, 1936, 1937). Of the eight dancing grounds, four were open grassy knolls, one in an open marsh, two on buckwheat stubble, and one on a fairly open knoll with a few jack pines.

Sharp-tails were known to dance at 11 "casual" spots on ditch banks, food patches, grassy knolls, and meadows. Five of these spots were used on several occasions, 6 apparently but once.

As with Prairie Chicken, the first Sharp-tail display occurred in late winter, in 1938 on the fourth of February. Grange (1936) reports fighting "as early as the middle of February, although March is the more usual time in Wisconsin and Minnesota." The main season, marked by regular early morning and evening dancing, came a little earlier than the Prairie Chicken's booming season, and like it tapered off to a gradual end. Here again there was a summer and early autumn period during which Sharp-tails came to the grounds but did not dance. In late October, 1938, I found Sharp-tails dancing, as vigorously as in spring, on three dancing grounds and at three other places. Several dancing grounds were used as winter loafing places. Marshall and Jensen (1937) found that Columbian Sharp-tails often range year-long close to their dancing grounds.

Joint Booming and Dancing Grounds

Three of these booming and dancing grounds—one a marsh and the other two knolls in bluegrass pastures—were used jointly, with both species in action at the same time. Several booming grounds were used casually by Sharp-tails, and a few dancing grounds were also casual booming places. These were at food patches at which both Prairie Chicken and Sharp-tails had fed through the winter, and most of the casual visitors were seen in spring.

Nesting Habits of Prairie Chicken and Sharp-tails

Twenty-three nests of Prairie Chicken and 17 of Sharp-tails were found by nest hunting crews and other cooperators.

Data on nesting chronology are given in Tables 1 and 2, fertility

TABLE 1
Nesting Chronology:
Prairie Chicken

	Apr. 1–15	Apr. 16–30	May 1–15	May 16–31	June 1–15	June 16–30	July 1–15	Year & Source of Data
Laying began	4	7	11	3	3	1	0	1929–30, Gross
	1	5	2	2	3	0	0	1936–37, Hamerstrom
	5	12	13	6	6	1	0	1929–30 1936–37
Hatched in				3	7	5	2	1929–30, Gross
				0	2	2	4	1936–37, Hamerstrom
				3	9	7	6	1929–30 1936–37

TABLE 2
Nesting Chronology:
Sharp-tailed Grouse

	Apr. 1–15	Apr. 16–30	May 1–15	May 16–31	June 1–15	June 16–30	July 1–15	Year & Source of Data
Laying began	1	3	0	0				1930, Gross
	0	4	2	3				1936–37, Hamerstrom
	1	7	2	3				1930 1936–37
Hatched in					4	0	0	1930, Gross
					4	0	2	1936–37, Hamerstrom
					8	0	2	1930 1936–37

and viability of eggs in Tables 3 and 4, size of completed clutches in Table 5, 6, and 7, and causes of nest failures in Table 8. I have drawn upon Gross' (1930) report on his central Wisconsin nesting study and unpublished notes of the late Franklin J. W. Schmidt (in the files of Prof. Aldo Leopold) in order to bring together all the available Wisconsin material.

TABLE 3
FERTILITY AND VIABILITY OF EGGS:
PRAIRIE CHICKEN

No. of clutches	No. of eggs	Fertility	No. of fertile eggs	Dead embryos	Year and source of data
20	248	97.6%	242	8.3%**	1929–30 Gross
9	95	98.9%	92*	2.2%	1936–37 Hamerstrom
29	343	98.0%	334	6.6%	1929–30 1936–37

*The remaining fertile eggs were broken or deserted before the hatching date.
** Over half (11 of 20) were in one nest, and probably died of excessive heat rather than inherent weakness.

TABLE 4
FERTILITY AND VIABILITY OF EGGS:
SHARP-TAILED GROUSE

No. of clutches	No. of eggs	Fertility	No. of fertile eggs	Dead embryos	Year and source of data
5	60	100.0%	60	0.0%	1930 Gross
7	76	98.7%	61*	1.6%	1936–37 Hamerstrom
12	136	99.3%	121	0.8%	1930 1936–37

*The remaining fertile eggs were broken or deserted before the hatching date.

TABLE 5
NUMBER OF EGGS PER COMPLETED CLUTCH:
PRAIRIE CHICKEN

Year	Av. size of clutch	Range	No. of clutches	Source of data
1929	12.0	10–17	8	Gross
1930	11.9	9–17	22	"
1931	11.6	?	12	Schmidt
1932	13.8	?	12	"
1936	11.1	8–13	8	Hamerstrom
1937	10.0*	5–15	4	"
6 years	12.0	5–17	66	

* One clutch was of only five eggs. It may have been atypical, in which case the other three, averaging 11.7 eggs, might be closer to the true figure.

TABLE 6

NUMBER OF EGGS PER COMPLETED CLUTCH: SHARP-TAILED GROUSE

Year	Av. size of clutch	Range	No. of clutches	Source of data
1930	12.8	11–17	5	Gross
1931	11.8	?	15	Schmidt
1932	13.3	?	8	"
1936	11.4	9–13	5	Hamerstrom
1937	10.3**	9–11	3	"
5 years	12.1	9–17	36	

** Misleadingly low. Four other clutches which may or may not have been complete contained 11, 11, 11, and 13 eggs.

TABLE 7

SEASONAL DECLINE IN SIZE OF CLUTCH: PRAIRIE CHICKEN

	Apr. 1–15	Apr. 16–30	May 1–15	May 16–31	June 1–15	June 16–30	Year and source of data
Av. no. of eggs per completed clutch begun:	15	11.7	11.5	11.2		10.0	1929–30 Gross
No. of completed clutches	4	7	11	4		1	
Av. no. of eggs per completed clutch begun:	15	13	13	10.5	7.3		1936–37 Hamerstrom
No. of completed clutches	1	2	2	2	3		
Av. no. of eggs per completed clutch begun:	15	12.0	11.7	11.0	7.3	10.0	1929–30 1936–37
No. of completed clutches	5	9	13	6	3	1	

The tables show that:

(a) The nesting season of both Prairie Chicken and Sharp-tails extends from the first half of April into the first half of July. A few Prairie Chicken may hatch as late as the last half of July, as shown by the fact that at least one clutch was begun in late June.

(b) Most of the nests of both species are begun in late April and early May, during the height of the booming and dancing seasons.

(c) Fertility of both species is very high, and few of the fertile eggs fail to hatch. Some eggs hatch after the brood has left the nest and are thus lost; but hatches observed by Gross (1930) and Cleveland Grant (unpublished) show that such losses are slight.

TABLE 8

CAUSES OF NEST FAILURES:
PRAIRIE CHICKEN AND SHARP-TAILED GROUSE

	Skunk	Dog, fox or coyote	Man**	Mink	Unident. mammal	Crow	Horned Owl	Flooded	Heat of Sun	Destroyed—Agent unknown	Deserted—Cause unknown	Eggs taken for expt. hatching	Success or failure unknown	Total nests found	No. hatched	Year and source of data
Prairie Chicken		3*	1	1*		4	1*	4	1	2	3	2		42	20	1929–30. Gross.
	4	1*	1							5*			1	23	11	1936–37. Hamerstrom
Totals, PC	4	4	2	1		4	1	4	1	7	3	2	1	65	31	1929–30; 1936–37
Sharp-tailed Grouse														5	5	1930. Gross
	3	1	2		1					2	1		1	17	6	1936–37. Hamerstrom
Totals, ST	3	1	2		1					2	1		1	22	11	1930, 1936–37
Totals, PC & ST	7	5	4	1	1	4	1	4	1	9	4	2	2	87	42	1929–30, 1936–37

* Nesting hen mortality: 3 killed by coyotes, one each by mink and Great Horned Owl, one by unknown predator.

** Nests destroyed through acts of man: one each in plowing and mowing, one because of nest hunting crew, one because of dyke-building crew.

(d) Prairie Chicken clutches over a six-year period averaged 12.0 eggs, range 5 to 17; Sharp-tail clutches over a five-year period averaged 12.1 eggs, range 9 to 17. Ralph King's well-known but unpublished statement that in Ruffed Grouse there is a marked cycle, inversely synchronized with the population cycle, in the size of the clutch has raised the question for other grouse. The tables show no such trend. There is no significant variation from the average mid-way in the rise of the cycle (Gross' nests), at the high (Schmidt's nests), or just past the low (Hamerstrom's nests).

(e) Prairie Chicken clutches grow progressively smaller in size as the nesting season advances, with the largest begun during the height of the booming season. Sharp-tail data on this point are still incomplete.

(f) As with most gallinaceous birds, nest failures were very frequent. Schmidt's notes bear out this statement: of 38 Prairie Chicken nests which he studied in 1931, half were destroyed or deserted. Thus, of 100 Prairie Chicken nests studied during five years, one half failed

TABLE 9
NESTS FOUND IN DIFFERENT COVER TYPES, 1936–37

Cover type	Prairie Chicken	Sharp-tailed Grouse	Ruffed Grouse	Mallard	Blue-winged Teal	Total	Cover plants which make up the type
Dry marsh or marsh edge.	3	1		2	4	10	*Calamagrostis* sp., or *Carex* spp., with varying amounts of mixed *Carex* spp., *Rubus villosus* (?-dewberry), *Solidago* sp., *Spirea salicifolia;* may be a few scattered patches of invading low *Populus tremuloides, Salix* spp.
Grass meadow along drainage ditch. May show slight brush invasion.	11	2		1	4	18	*Poa pratensis, Phleum pratense,* plus those above; plus scattered invading low *Prunus pennsylvanica, Pinus Banksiana.*
Open edges of, or small* openings in, open jack pine-scrub oak woods.	3	2		1		6	*Andropogon furcatus, A. scoparius, Carex pennsylvanicus, Vaccinium pennsylvanicum, Myrica asplenifolia.*
Bank of major drainage ditch.				1		1	Same as for marsh edge, plus *Rubus* spp. (raspberry, blackberry), clumps of *Populus tremuloides, Salix* spp., *Prunus pennsylvanica,* occasional *Betula alba* var. *papyrifera.*
Small* openings in light stands of brushy aspen or willow.	2					2	*Calamagrostis* sp., *Rubus villosus* (?-dewberry), *Solidago* sp.
Small* openings in dense stands of brush: generally aspen or willow.		3	1	7	1	12	Same as next above.
Scattered brush, small trees, and grass; fairly open.	3	1		3	2	9	*Populus tremuloides, Salix* spp., *Pyrus melanocarpa, Vaccinium pennsylvanicum, Pinus Banksiana;* undercover as next above.
Same, as strip at edge of marsh, dense brush, or woods.		8	2	6		16	Same as next above.
Dense tall brush, generally aspen or willow.			1**	1		2	*Populus tremuloides, Salix* spp.; undercover *Calamagrostis* sp.
Rather dense mixed hardwoods.	1		1**			2	Mainly *Quercus* spp., with *Populus tremuloides, Ulmus americana, Betula alba* var. *papyrifera,* undercover *Pyrus melanocarpa, Corylus americana, Rosa* sp.
Total nests	23	17	5	22	11	78	

*From 50 feet in diameter to a half-acre in size.
**Ruffed Grouse nest at the edge of the stand.

to hatch. As far as the data go, this mortality rate of 50 per cent shows no significant variation during different phases of the cycle. It was the same mid-way in the rise of the cycle (1929-30), just before the high (1931), and just after the low (1936-37).

Do Prairie Chicken and Sharp-tails raise more than one brood a year? Do they re-nest if early nests are destroyed? I know of no direct evidence on either of these questions. The shortness of the mating season would seem to rule out the first. By analogy the following line of evidence might be adduced for the second: (a) nesting frequency data for Prairie Chicken (Table 1) are similar to those of Quail (Stoddard, 1931; Errington, 1933), Hungarian Partridge (Yeatter, 1934; Middleton, 1936), and Pheasant (Hamerstrom, 1936; Errington and Hamerstrom, 1937), but the peak comes earlier and the spread embraces a shorter time-span; (b) like those species, Prairie Chicken lay smaller and smaller clutches as the nesting season progresses; (c) spread of nesting dates and declining clutch in these species reflect re-nestings; (d) Prairie Chicken, by analogy, probably do re-nest but to a far smaller extent. The argument is supported by V. W. Lehmann (MS) who has found that the Attwater Prairie Chicken (*T. c. attwateri*) sometimes re-nests. If Prairie Chicken do re-nest, the proportion of hens which actually bring off a hatch is higher than that implied by the number of nest failures, as in the case of Pheasants (Errington and Hamerstrom, 1937).

Nine of the 23 Prairie Chicken nests were within a half mile of a booming ground, 10 between a half mile and a mile and a quarter. The distances from the other four to the nearest booming ground were unknown. The same thing seems to hold for Sharp-tails, although, since both nests and dancing grounds were harder to find, I have fewer instances to draw upon. Figure 2 is witness that this grouping of nests is not chance distribution. Schmidt (MS) found that most Prairie Chicken and Sharp-tail nests were within a mile of booming or dancing grounds.

However, 6 nests of Prairie Chicken and four of Sharp-tails were as near (or nearer) the casual as the regular booming or dancing grounds. Where did mating occur? It is often assumed that hens come to the booming and dancing grounds to be bred: these observations, plus the many other instances of casual displays, suggest that mating may occur at other places as well.

Cover types used for nesting are shown in Table 9. They agree with those already noted by Gross (1930) and Bent (1932). Schmidt (MS) noted the value of haymarshes and drained-peat grasslands as nesting cover for both species. His findings, like mine, showed that the sparse vegetation of sand prairies is seldom used for nesting. One point of significant difference stands out: Schmidt concluded that sphagnum bogs are particularly important as nesting cover for Sharp-tails. The

*From 50 feet in diameter to a half-acre in size.
**Ruffed Grouse nest at the edge of the stand.

relatively small quantity of this sort of cover on the Project may account for the discrepancy in our findings. It may, in fact, explain why I saw more nests of Prairie Chicken than of Sharp-tails even though

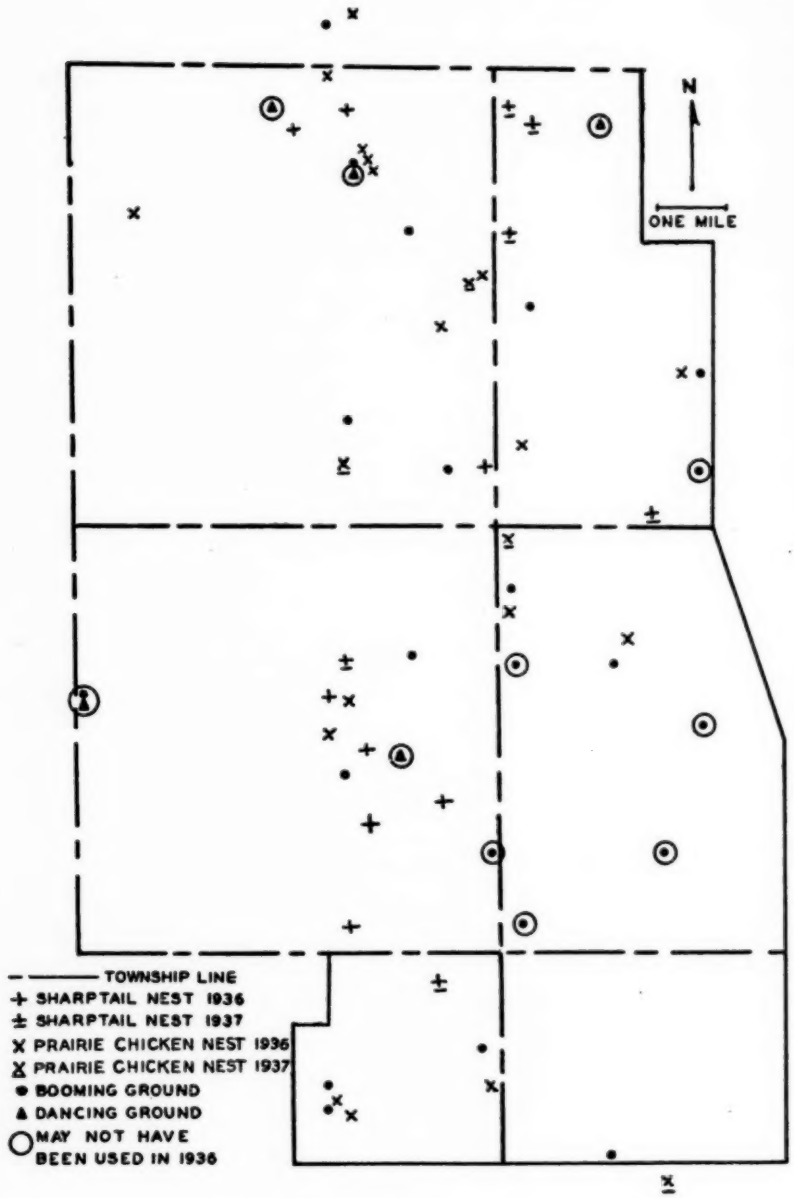

Figure 2. Map of part of the study area, showing nests, booming grounds, and dancing grounds.

there were, during the winter, many more Sharp-tails on the area than Prairie Chicken.

To make the discussion of nesting ecology more complete, I have included in Table 9 some of the other species whose nests were found in the same types of cover.

Nests of both Prairie Chicken and Sharp-tails were made by lining shallow bowl-shaped depressions in the ground with grasses, leaves, or small twigs, apparently scraped together from material at the spot. Concealment of nests was quite variable, but since man-made estimates have been shown to be of questionable value, in terms of relative security from predators (Hamerstrom, 1936; Kalmbach, 1937), I omit a tabulation of this factor. No nests were roofed, although the cover often arched naturally over them. Eggs were not covered while the hen was away.

Many plants were included in the cover at the nests. A few, however, occurred again and again at the nests of all five species. They were: bluejoint, sedges, goldenrod, dewberry—Yeatter (1937) has already commented on the value of this plant—bluegrass, willows, blueberry, sweet fern, and aspen. An abundance of these plants is, on the Project, generally an indication of better soils.

More important than the individual cover plants is the fact that most of the nests of all species were in cover mixtures rather than in pure stands. Conversely, 448 acres of haymeadow, chosen for cutting because the grass was particularly free from "weeds" and brush (i.e., mixtures) were examined a day or two after mowing: no nests were found. Two Prairie Chicken nests were found by farmers cutting hay in other fields, but in both cases sedge clumps or dewberry were part of the nest cover.

What was the origin of these cover mixtures? Everyone knows what a cover edge is. One glance is enough to tell where the woods end and the meadow begins, a second to see the fringe of brush between. But the significance of that combination of woods, brush, and meadow is not to be grasped in a casual moment. The key lies in the fringe of brush. It is a battle ground with the grass of the meadow in the role of defender. The shrubs of the brush zone act as skirmishers: trees generally cannot invade grassland directly, brush must go before. When it has weakened the sod and taken over the battle zone trees come in from behind. With the heavy fighting won, shrub is shaded out by tree, and the edge of the woods has advanced another notch. Grass retreats before brush, woods advance from the rear. It is one step in plant succession (Weaver and Clements, 1929).

So also with marshes, but with another step added. The dead tops of the marsh plants, as they die back each winter, slowly fill the basin. Since a marsh is shallowest toward the shore, it is there that the filling in is first complete. The shoreline, like a slowly tightened noose, draws

in toward the center. On the drier parts of this new ground the old fight between brush and sod continues, with trees again the final victor. Plant succession in the marshes also moves at a slow march toward a forest stage.

Normal succession is slow. The central Wisconsin marshes have persisted since the last glacial period, but the peat beds are witness that succession has been slowly moving forward.

Now comes man. In a space of time, geologically speaking, no longer than a flash of the wing of a drumming Partridge he has thrown the slow orderly process out of gear. On the uplands, lumbering and fire have turned the forest back to the brush stage in many areas. Marsh succession has been tremendously speeded up by drainage, which has encouraged the peripheral advance of brush; and by drainage followed by severe fires, which has jumped the burned peat basins into solid stands of brushy aspen in a single season.

The origin of the grass meadows is more complex. Once marshes, they have become bluegrass meadow through an involved series of ecological changes which Frolik (1936) has traced as follows:

In those marshes which did not have their sod destroyed by fire, the original grasses and sedges persisted for a time. They were mowed and grazed. The now drier soil was compacted under the feet of grazing animals. Drying and packing of the soil weakened the old sod, encouraged the development of a new one made up of bluegrass and timothy. In such wise bluejoint-sedge marshes became bluegrass-timothy meadows. Mowing, grazing, and light burning kept brush out.

In the meadows mixed cover for nesting, as opposed to pure stands of grass, was made by further disturbance. The new sod was broken in spots, as by over-grazing, plowing, grub injury. In these spots succession was turned back to a stage characterized by goldenrod, aster, and dewberry.

It was in the zone of mixed plants between brush and open, and between grass and herbs, that nearly every nest was found. Prairie Chicken and teal preferred the more open nesting sites, Sharp-tails, Ruffed Grouse, and Mallards the heavier brush.

Man-made changes have provided just these types of cover, but they must be directed toward a better balance. Wildlife management is mainly planned regulation of plant succession: without it, on the Project, it is only a matter of time until succession has gone beyond the proper stage for booming, dancing, and nesting ground cover. Brush invasion, particularly by aspen, has already been pushed too far.

The water restoration program has begun to win back some of the aspen flats to marsh grass. With the removal of resident farmers, provision must be made to mow, graze, or lightly burn meadows and marsh edges to keep them open. Probably all three will be necessary, as mowing alone tends to make a sharp edge between brush and grass

in place of the natural gradation from one to the other. Spot plowing may be needed to maintain patches of mixed herbaceous vegetation in the meadows and marsh edges.

Man has already interfered once to increase by a thousand-fold the speed of succession in the grasslands. He must now put a bridle on the natural forces which he has loosed. He once, by accident, made here the best Prairie Chicken country in the Middle West: can he now, by design, do it again?

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GENERAL NOTES

Records of the Sooty Tern and Swallow-tailed Kite in Alabama.—On March 20, 1938, following a hard "blow" from the South, an exhausted tern was picked up on the lawn of the Fairhope Hotel, Fairhope, Baldwin County, Alabama. The bird died soon after and was given to Mr. Duncan McIntosh, of Fairhope, who prepared the skin for his collection. Due to decomposition, the sex could not be determined. Mr. McIntosh kindly allowed me to examine the skin and on comparing it with known skins in the University of Michigan Museum of Zoology, it proved to be a Sooty Tern, *Sterna fuscata fuscata*. I believe this to be the first record of the occurrence of the Sooty Tern in Alabama.

On May 14, 1938, I observed a Swallow-tailed Kite, *Elanoides forficatus*, sailing over a grove of live oaks on the eastern shore of Mobile Bay about one mile north of Daphne, Baldwin County, Alabama. The bird was watched for some time as it wheeled and glided overhead, frequently coming within a hundred yards, and at a rather low altitude. The white head, neck, and underparts, as well as the black back, and deeply forked tail were clearly visible, leaving no doubt as to its identity. Listed below are all published records, to my knowledge, for the occurrence of this species in the State.

1858 Dallas County. P. H. Gosse ("Letters from Alabama," 1859: 216–217), "seen nearly every day [in July] associating in little groups." (Gosse, *fide* A. H. Howell, "Birds of Alabama," 1924, pp. 128–9).

1889 Autauga County, Autaugaville, about March, 1889, one seen by L. S. Golsan. A. H. Howell (*loc. cit.*).

1890 Hale County, near Greensboro along the Warrior River. W. C. Avery (*Amer. Field*, **34**, 1890: 584) says "Not common. Once abundant. It may breed along the Warrior River [near Greensboro] where now occasionally seen." A. H. Howell (*loc. cit.*).

1909 Montgomery County, Barachias on May 1, 1909, one seen by E. G. Holt (*Auk*, **31**, 1914: 220).

1911 Baldwin County, Chuckee [not Chuckvee] Bay on May 12, 1911, one seen by A. H. Howell (*loc. cit.*).

1921 Geneva County, Hartford on January 26, 1921, one specimen shot. P. A. Brannon (*Auk*, **38**, 1921: 464).

1932 Baldwin County, Fairhope on April 20, 1932, one seen by Duncan McIntosh. Helen M. Edwards (*Auk*, **50**, 1933: 234).

1938 Baldwin County, near Daphne on May 14, 1938, one seen by Fred S. Barkalow, Jr.

—Fred S. Barkalow, Jr., *Alabama Polytechnic Institute, Auburn, Alabama.*

Comparison of the Food of White-necked Ravens and Crows in Oklahoma.—In southwestern Oklahoma it is not uncommon to find White-necked Ravens (*Corvus cryptoleucus*) among the flocks of wintering Crows (*Corvus brachyrhynchos*).

The bombing by State officials of a large Crow roost near Dempsey, Okla., on December 10, 1937, when an estimated 26,000 birds were killed, provided an unusual opportunity to compare the food habits of these two species. A few White-necked Ravens were noticed among the dead and a careful search revealed 20 of these birds. The stomachs of all were saved as well as those of 20 Crows, selected at random in various parts of the roost for comparison. These were examined in the Denver Laboratory of Food Habits Research of the U. S. Biological Survey.

Stomachs of 17 of the Ravens and 14 of the Crows contained food. From the appended table it will be noted that about half of the food of each species consisted of grain sorghums and corn. Insects, mostly grasshoppers, were a prominent food item of the Crows but less so of Ravens. Seeds of sunflowers, melons, and citrons were numerous in most of the Crow stomachs but only occasional in those of the Ravens. Hackberries constituted more than one-third of the food of the Ravens but were not found in the stomachs of the Crows; hackberries were eaten, however, by some Oklahoma Crows taken in nearby localities.

The Crows were apparently more beneficial in their feeding habits than the White-necked Ravens since they ate many more insects and weed seeds. The melons eaten at this season were waste products left in the field. Since the Crows had obtained more insects and sunflower seeds and less hackberries, it would appear that they fed on the ground more than did the Ravens.

Table showing percentages by volume of the food of White-necked Ravens and Crows collected at the Dempsey, Oklahoma roost, December, 1937.

Birds	Beetles	Grasshoppers	Mammals	Grain sorghums	Corn	Melons and citron seeds	Hackberries	Sunflowers	Debris
Crows	4.6	9.4	1.2	24.7	24.9	18.9	0.	16.3	0.
White-necked Ravens..	.1	1.8	4.5	29.8	17.3	3.0	37.5	4.5	1.5

RALPH H. IMLER, *Food Habits Laboratory, U. S. Biological Survey, Denver, Colorado.*

Long-billed Marsh Wren in Mason County, West Vriginia.—Previous records from West Virginia show that only the eastern form of the Long-billed Marsh Wren (*Telmatodytes p. palustris*) has been found within the bounds of the State. While collecting birds near Lakin, I secured a male Long-billed Marsh Wren on September 17, 1937, in an overgrown weedy bottomland along the Ohio River. After comparing my specimen with the series in the Carnegie Museum, Pittsburgh, Pa., I labeled it as *T. p. iliacus*, a form not recorded in West Virginia so far as I am aware. The specimen was later examined by Dr. H. C. Oberholser, of the U.S. Biological Survey, who confirmed my identification.

According to the views of Mr. W. E. Clyde Todd (*Proc. Biol. Soc. Wash.*, 50, 1937: 23–24), the name properly applying to the race of the interior (east to the Appalachians) is *iliacus* instead of *dissaëptus*, which is inseparable from true *palustris* of the Atlantic coast region, from Virginia northward.—KARL HALLER, *Bethany College, Bethany, West Virginia.*

Notes from Mississippi.—The following notes comprise a record of species as residents and as winter visitants in the immediate vicinity of Rosedale, Mississippi. I am greatly indebted to Dr. Harry C. Oberholser of the U.S. Bureau of Biological Survey for subspecific identifications.

Loggerhead Shrike, *Lanius ludovicianus ludovicianus*. Four specimens were collected: two males on January 2, 1938; a male on July 25, 1937; and a female on August 5, 1937. The last two being in moulting plumage proved that this is the nesting form in this section of the Mississippi Valley.

Red-eyed Towhee, *Pipilo erythrophthalmus erythrophthalmus*. One specimen of this subspecies, a male, was taken March 13, 1937.

Alabama Towhee, *Pipilo erythrophthalmus canaster*. Two male specimens of this form were collected, one on December 28, 1929; the other February 20, 1937.

Mississippi Song Sparrow, *Melospiza melodia beata*. A small series of three males were secured on January 16, February 27, and March 3, 1937. This subspecies has never before been recorded from Mississippi.—M. GORDON VAIDEN, *Rosedale, Bolivar County, Mississippi.*

"Territorial Song" and Non-territorial Behavior of Goldfinches in Ohio.—My notes on *Spinus tristis tristis* in Columbus, Ohio, are fragmentary, yet they possess two points of interest, one concerning a form of song which I have not found described elsewhere, the other concerning their method of nesting which was more colonial than territorial.

A short, unmusical song, lasting from one to 2.3 seconds, usually about 2 seconds, and given 5 to 7 times a minute, was noted from mid-April to mid-May from 1929 to 1933. These songs showed considerable variety, but the first portion was usually harsh, while the second had a slight suggestion of typical Goldfinch quality.

Goldfinches were present in large numbers in our garden at this season, attracted by the abundance of dandelion seeds; they chased one another and sang these short songs as well as the prolonged, musical, ecstatic songs lasting 6 to 8 seconds with a pause of only a second between songs. Although this short song suggested a typical "territorial" song in its form and rate of delivery, yet it flourished two months before nesting began. Only once did I record it in summer; on August 3, 1930, I noted a male singing a short song across the ditch from a nest.

Goldfinches were noted in pairs April 24, 1931, and May 27, 1933, but on May 14, 1930, some were in pairs, while others were not. Strangely enough, on May 30, 1930, I saw a pair starting to build, the male with a strand in his beak, his mate weaving material into position in the crotch of a small elder. No further work was done on this nest, and it was not until July 15 that I found a nest which was being worked on in earnest. The first egg was laid July 22.

That summer I located a dozen nests, but we left before any of the young were fledged; in the fall I found 6 more. Ten were in Canada thistles and 3 in tiny trees, the height of the nests ranging from 3 to 5.5 feet above the ground, averaging 3.5 feet. Five were in medium sized trees, placed from 8 to 12 feet from the ground. The number of eggs in 7 complete sets was 4, 4, 4, 4, 5, 5, 6. Incubation in one case lasted 12 days. Two-thirds of the nests were judged, from the excreta around the rims, to have raised young, a proportion that agrees well with Dr. Walkinshaw's results.

The 18 nests probably represented 15 pairs; of these 12 had nested in groups —4 pairs in about an acre, 3 in about two acres and 5 in about two acres. This grouping was not dependent on the availability of nesting sites, for thistles abounded everywhere. It seemed to be a sociable tendency as reported by Dr. L. H. Walkinshaw (Life History Studies of the Eastern Goldfinch. *Jack-Pine Warbler*, 16, 1938: 3–11, 14–15; 17, 1939: 3–12), and differing markedly from the territorial behavior found by Margaret Drum.—MARGARET M. NICE, *5708 Kenwood Avenue, Chicago, Illinois.*

EDITORIAL

If members will notify the Editor as early as possible of any changes in address the Club will be saved much unnecessary expense now being incurred because of *Bulletins* which are lost or have to be forwarded. The cost of forwarding a *Bulletin* may amount in some cases to ten times the cost of the original mailing. The Editor will promptly forward notice of address changes to the Secretary and the Treasurer.

Our Secretary has prepared and had printed some attractive circulars of information about the characteristics and objectives of the Club. He will, on request, supply copies to any members who are willing to assist in the important work of securing new members. Increasing our membership will, among other things, make it possible to publish a larger and better illustrated *Bulletin*.

The complete stock of back numbers of the *Bulletin* has now been brought to Ann Arbor and consolidated. Mr. Harrell and an assistant have completed the herculean task of sorting, indexing, and storing the *Bulletins* so that we now know for the first time in many years just what stock is available of each issue. Details and prices will be found on page 130 of this issue.

In view of the increasing prevalence of short-cut, "just-as-good" methods of binding, members of the Wilson Ornithological Club should perhaps be reminded of the points to watch for when binding their volumes of the *Bulletin*.

The most common method of cutting the cost of binding is by substituting machine sewing or even stapling for hand sewing. In these slightly cheaper methods the backs of the signatures are cut and the life of the volume thereby greatly shortened. Another serious consequence is that a volume so bound will not readily open out flat for easy reading. If the covers of the magazines are bound in place it will facilitate turning quickly to the number desired and will increase the value of the volume by preserving the data printed on the covers. Book collectors always specify that bindings shall be "absolutely untrimmed." There is nothing to be gained by trimming a smooth-edged magazine like the *Bulletin* but most binders have the habit of trimming the edges of everything they bind unless they receive contrary orders. The material used in binding is also worth considering. Buckram costs very little more than cloth and is much more durable. In binding a continuing periodical it is wise to choose a standard color which can be quite surely matched when future volumes are ready to be bound. The lettering on the backs may also be skimped by unreliable workmen. A cheap gilt lettering may look much like gold leaf when new but it will become black and illegible in a comparatively short time.

It is well worth while to specify carefully how one's books and magazines shall be bound. Not only does such care increase their beauty and usefulness but it materially adds to their resale value against the time when one may wish or need to realize on their value. Any book collector will gladly pay more for a correctly bound book or periodical.

Annual Meeting

Plans for the Annual Meeting on December 1 and 2 at Louisville, Kentucky are rapidly being perfected by our Secretary and the Local Committee on Arrangements under the chairmanship of Burt L. Monroe. An important feature of the meeting will be an exhibit of bird photographs. In order that members may prepare for this exhibit well in advance, our Secretary and the Local Committee have drawn up the regulations presented below.

Regulations of the Bird Photograph Exhibit

1. The Exhibit is open *only* to photographs by members of the Wilson Ornithological Club.
2. Photographs presented at the Exhibit must be of living birds, their nests, or eggs.
3. There will be two classifications for photographs: A black and white classification and a natural color classification (*i.e.* photographs taken with color film).
4. Each member may exhibit not more than *three* photographs in each classification.
5. Black and white photographs must not be less than eight inches by ten inches (8″ x 10″) in size.
6. Natural color photographs must not be less than four inches by five inches (4″ x 5″) in size.
7. Photographs, unless framed or printed on double-weight paper, must be mounted on stiff cardboard or some similar material.
8. Mats, borders, frames, or frames with glass, may or may not be used, depending on the wishes of the members submitting the photographs. If photographs are framed, members are asked to provide devices (eyelets and wire) for hanging them. Members are also urged *not* to print their photographs on glossy paper.
9. Each photograph must bear the following information:
   (1) Title of picture
   (2) Name of member and return address
   (3) Locality where taken
   (4) Kind of camera and film used
10. Photographs should be sent to Mr. Burt L. Monroe, Chairman of the Local Committee on Arrangements, 207 N. Birchwood Ave., Louisville, Kentucky. *Photographs must be in his hands not later than November 25, 1939.*
11. The Local Committee will provide return transportation.
12. The Local Committee reserves the right to reject photographs that do not conform to the above regulations or do not seem suitable for the Exhibit. The Committee also may withhold showing natural color transparencies if sufficient lighting is not available in the exhibition rooms.

Ornithological News

Alexander Wetmore returned to Washington in early May from a successful trip devoted to exploration and collecting in Vera Cruz.

A. J. van Rossem has been granted a Guggenheim Fellowship to "study the ornithological collections of Europe to determine the exact status of the types and specimens upon which the names of American birds were originally based, with a view to the establishment of a permanent nomenclature."

Alexander W. Blain, formerly Editor of the Bulletin of the Michigan Ornithological Club, has been appointed by the Governor of Michigan to the State Conservation Commission.

David Lack has returned to this country from the Galapagos Islands where he studied the habitats and life histories of all of the principal species of *Geospiza*. It was observation of the peculiarities of these remarkable birds, which are confined to the Galapagos, that apparently first turned Darwin's attention toward the problems of evolution and H. S. Swarth in 1931 concluded his noted taxonomic study of the great California series of *Geospiza* specimens by calling attention to the great need for a study of these birds in life.

David E. Davis, who has been studying the Common Ani (*Crotophaga ani*) in Cuba, is now going to British Guiana to study the Great Ani (*Crotophaga major*).

ORNITHOLOGICAL LITERATURE

BICKNELL'S THRUSH, ITS TAXONOMY, DISTRIBUTION, AND LIFE HISTORY. By George J. Wallace, Proceedings of the Boston Society of Natural History, 41, no. 6, January, 1939: 211–402. $1.25.

This monograph is based on three years' study of Bicknell's Thursh from the taxonomic, distributional, and life history points of view, and is, therefore, appropriately separated into these three natural divisions.

It was the original intention of the author to present a purely life history study but systematic confusion existing among the Gray-cheeked Thrushes made it necessary to make a complete taxonomic revision of the species-group before presenting the study. He finds that there are four more or less distinct phases among these thrushes, two of which—a small olive and a small brown form—occur in Bicknell's Thrush. Nevertheless there is inadequate evidence for recognizing these four color types as subspecies. The present scientific name of Bicknell's Thrush, *Hylocichla minima minima* (Lafresnaye), is declared invalid since the type specimen of Lafresnaye's *Turdus minimus* is actually the larger Gray-cheeked Thrush. Bicknell's Thrush should now become *Hylocichla minima bicknelli* Ridgway, a name once used but rejected when Lafresnaye's type was rediscovered.

Bicknell's Thrush is notably restricted in distribution, breeding in the United States only on the highest northeastern mountains, migrating along the Atlantic Coast, and wintering, so far as known, in Haiti and San Domingo. Bicknell's Thrush is also restricted by a low breeding rate. The birds "lay three eggs as often as four, and seldom attempt a second brood; the loss due to infertility and defective embryos is high; and the loss due to predators, chiefly red squirrels, is more than 50 per cent." The author believes that Bicknell's Thrush reaches its center of abundance in the Green Mountains of Vermont, since this extensive mountainous area, with the majority of its peaks wooded over the top, provide optimum breeding conditions.

The life history studies of Bicknell's Thrush were made on Mt. Mansfield, Vermont, and comprised two summers' work. The section of the monograph devoted to these studies is introduced with a discussion of climatic and ecological aspects of the region and is followed by more detailed and informative discussions under such topics as arrival on breeding grounds, food habits, songs and call notes, mating and courtship, nesting habits, a study of caged specimens, molts, and departure from the mountain. The bird is restricted to the evergreen zone, having an altitudinal distribution of about 1500 feet. Bicknell's Thrush is said to be "the most insectivorous of the hylocichlids" although no direct evidence is given to support this statement. In addition to its regular song, the bird occasionally gives a flight song that "is confined to the twilight following sunset or preceding sunrise, and lasts for only ten or fifteen minutes." Regular singing "is renewed when nests are broken up, regardless of the time, and is renewed in early July at the conclusion of the nesting period, regardless of the fate of the young." Only the female incubates, a fact confirmed by studies of nine nests. Both parents cooperate in feeding the young but the male is "irregular" and "effectively concentrates his efforts to periods of necessity such as during heavy or prolonged rains and in the early morning, at which times the female remains at the nest to brood." At one nest studied, three adults fed the young, the third bird probably being an "extra male." At another nest the male deserted, leaving the entire care of the young to the female. The female usually brings a larger load of food to the nest than the male. The remark that "the parent broods more than has been commonly observed for other passerine birds is doubtless related to the severer climate" is not convincingly supported by data. The suggestion that young in one nest were "frightened" at the sudden approach of a thunderstorm does not seem in keeping with general wild bird behavior and would be difficult to prove. Male birds are

more inclined to carry away excreta from the nest than to eat it, the explanation being that the males are "better fed."

Dr. Wallace has given us an admirable picture of the life history of Bicknell's Thrush. Considering that he has dealt with the rarest of a notoriously seclusive group of birds, that there was comparatively little information on the bird to begin with, and that only two summers were involved in the studies, his picture is all the more admirable. The reviewer feels, however, that the general discussion of material would have been greatly enhanced by a comparison of his findings with the findings of investigators on other hylocichlids, and by a comparison of the results of his studies with the results of other extensive life history studies, particularly of passerine forms. Comparisons of this sort would have more greatly emphasized the significance of his findings.

The monograph is outstandingly well written and there are few typographical errors. "Rectrices" and "rectrical" are consistently mispelled and a term "apterylae" is used for the correct word "apteria." A bibliography and appendix conclude the monograph.—O. S. Pettingill, Jr.

THE GOLDEN PLOVER AND OTHER BIRDS. By Arthur A. Allen. Comstock Publishing Co., Ithaca, N. Y., 1939: 8vo, xiii + 324 pp., 240 photos., 7 color pls. $3.00.

The success of Dr. Arthur Allen's "American Bird Biographies" has resulted in the publication of this second volume of biographies done in the same manner. Its twenty-seven chapters deal with as many species or groups of species. The book is profusely illustrated with Dr. Allen's remarkable photographs and is further adorned with seven beautifully reproduced paintings by George M. Sutton. Dr. Sutton's amazing portraits of the Meadow Lark and the Golden Plovers are certainly among the finest things he has had reproduced.

Our only real criticism of this very attractive book concerns the author's adoption of the method of having the bird "tell its own story" in the first person. We feel that this technique introduces a false note which is very regrettable. Even the best passages give a false impression of the bird as a "little man" and the worst passages reach such high points of absurdity as the case of the Pied-billed Grebe that says, "I am blessed with a sense of humor," or the Indigo Bunting that speaks of Elliott Coues and aptosochromatism.

The Comstock Publishing Company and the Lakeside Press have made this a fine example of book making.—J. V.

THE JUNIOR BOOK OF BIRDS. By Roger Tory Peterson. Houghton Mifflin and Co., Boston, Mass., 1939: 8vo, xv + 92 pp., 24 colored pls. $2.00.

When one puts down the JUNIOR BOOK OF BIRDS one has a very satisfactory feeling that Master Roger Tory Peterson was a charming young man and that Mister Roger Tory Peterson has retained that charm while adding a wide and technical knowledge of birds. Indeed, so deep is that knowledge that he can use it lightly and gracefully. He has facility in selecting and describing the characteristics and habits of birds in such a way that a novitiate in ornithological study can easily understand and remember.

Most of the plates in this book have been printed before in the Audubon leaflets. It is regrettable that the color work is so badly done. The plates of the Indigo Bunting and the Blue Jay are especially poor. Outstanding are the two by Louis Agassiz Fuertes, and the only one by Mr. Peterson is by far the best. Young and old alike will prefer more color plates by the author. There is a modern touch to his work that unquestionably appeals to young minds (and to some older ones, if the reviewer is typical). However the black and white sketches in the margin, which are Mr. Peterson's work, compensate somewhat for the lack of his colored sketches.—Helen Bates.

THE WATCHER AT THE NEST. By Margaret Morse Nice. The MacMillan Co., N.Y., 1939: post 8vo, 159 pp., illus. $2.00.

If enthusiasm is contagious, readers of Margaret Morse Nice's "The Watcher at the Nest" should become ardent bird lovers. This pleasing book is written for laymen by a trained ornithologist. The lay reader who has imagination can read between the lines of this bright and popular account of bird studies, the principles which guide the scientific observer and sense, somewhat, the hours of patient work behind this pleasing exposé of the private lives of Song Sparrows, warblers and other birds. In no sense a scandal or debunking book, it reveals very clearly that it is impossible to interpret bird behaviour according to the patterns or mores of human beings.

The scientific student will be better satisfied by Mrs. Nice's technical book on the "Life History of The Song Sparrow," but he need have no hesitation in recommending this later book to his lay friends. It is a book which may gently induct them into more accurate bird study. It certainly will charm them, for it is remarkably free from pedantry, and on the whole very charmingly written. The author has an unusual vocabulary for a scientist, using a literary phraseology that is very happy. We suspect she had good training in non-scientific Latin. There are a few unfortunate passages, of which page 72 and the third paragraph on page 54, are typical. Clarification of pronouns would ease matters for the reader.

If a layman whose interest in birds is purely "sentimental" is bothered by the sentimentality of Mrs. Nice's descriptions and her tendency to place anthropomorphic interpretations upon the behaviour of her "darling" birds, still she may be excused because of the very laudable manner in which she has blended scientific knowledge and exposition for the untrained student. She has done much to further the cause of ornithology and it is to be hoped that more scientists will follow her example in interpreting ornithology to the laymen in simple narrative form. The niceties of our beautiful language are too often entirely neglected, and too many scientific treatises buried in libraries where they are used only for factual information. It is to be hoped that Mrs. Nice (or a fellow student) will write another book for the laymen explaining why ornithological study is more than just observation study. Many people would like to know why so able a person as Mrs. Nice will spend hours of acute discomfort in watching two little birds—be they ever so "darling". But let us be thankful for this one valuable addition to our list of worth while books.

The black and white illustrations by Roger Tory Peterson add much to the effectiveness of the book. We hope that the sales of this book will be great enough to induce the publishers to put out a finer edition and include some of Mr. Peterson's beautiful color work.—Helen Bates.

WILDFOWL FOOD PLANTS, THEIR VALUE, PROPAGATION, AND MANAGEMENT. By W. L. McAtee. Collegiate Press, Inc., Ames, Iowa, 1939: 8vo, ix + 141 pp., 17 pls., 4 figs. $1.50 postpaid.

This interesting handbook, written by one of the U. S. Biological Survey's recognized authorities on the food of animals, contains in condensed form an amazing amount of useful information about the value, propagation and management of wildfowl food plants in the United States. The author discusses such pertinent subjects as the productivity, value and utilization of plants, the environmental limitations affecting their growth, the control of undesirable plants, and the establishment or utilization of suitable plant habitats in ponds, marshes and estuaries. There are chapters with adequate accounts by families of the algae and the higher plants which are eaten by ducks and geese, and the vernacular names of these plants. The four figures and many tables (only eight are numbered) give much useful information in convenient form.

The portions dealing with environmental limitations, and their discussions of the effects upon plants of different hydrogen-ion concentrations, turbidity, salinity and pollution, and the basic fertility of various soils and waters, are especially valuable and well presented. The chapters dealing with plant management should be very useful to both the trained conservation worker and those who wish to increase the food of ducks and geese upon their lands.

One of the few statements in this volume which which we do not agree is the author's assumption that the freshwater dogfish (*Amia calva*) makes shallow waters turbid and thereby destroys vegetation or prevents their restoration (pp. 71 and 109). The only faults we find are the unavoidable results of brevity. The otherwise excellent chapter on environmental limitations of plants does not discuss ice-depth and ice-push, major factors in the elimination and restriction of aquatic growth in the northern States. Failure to emphasize sufficiently that vegetable matter is not the principal food of several waterfowl species may lead the beginner to over estimate the importance of plants to waterfowl. Additional plates picturing one or more species of each of the important plant families, and a few illustrations demonstrating the diverse forms which a single plant species assumes in various habitats, would have greatly added to the completeness of the work. Likewise a larger list of recent literature references (thirty-seven are given) would have been very helpful. Despite these "sins of omission" because of brevity, we predict a wide use for this timely manual.—Milton B. Trautman.

A Field Guide To The Birds. By Roger Tory Peterson. Houghton Mifflin Co., Boston, 1939: xx + 180 pp., 22 text figs., 41 unnumbered pls. (4 colored). $2.75.

Peterson's "Field Guide" is too well known to need any introduction. We received it with acclaim in 1934, recognizing it immediately as the handbook for identifying birds for which we had long hoped. It is a pleasure to report now a new and enlarged edition with a number of new illustrations and much additional text. The use of a more compact type arrangement has permitted the addition of brief geographical ranges, text references to all illustrations, and other new features, without the increase of more than a dozen pages of text.

We are glad to learn that the author is preparing a similar guide for the western half of the country.—J. V.

Short Papers

Crandall, L. S. Notes on Plumage Changes in the Quetzal. *Zoologica*, 24, No. 4, 1939: 61–2, 1 pl.

Fleming, J. H. and L. L. Snyder. On Melospiza melodia In Ontario. *Royal Ont. Mus. Zool. Occ. Papers* No. 5, Feb. 28, 1939 (8 pp., map).

Junk, W. Aves. *Scientiae Naturalis Bibliographia*, 2, 1939: 101–3.

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Moore, R. T. A New Race of *Cyanthus latirostris* From Guanajuato. *Proc. Biol. Soc. Wash.*, 52, Apr. 27, 1939: 57–60.—*C. l. propinquus* subsp. nov. from Guanajuato, Mex. Arizona form must be known as *C. l. magicus* (Mulsant and Verreaux).

Pettingill, O. S., Jr. The Bird Life Of The Grand Manan Archipelago. *Proc. Nova Scotian Inst. Sci.*, 19, pt. 4, Feb., 1939: 293–372, 3 pls., map.

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VAN ROSSEM, A. J. Four New Races of Sittidae and Certhiidae From Mexico. *Proc. Biol. Soc. Wash.*, 52, Feb. 4, 1939:3-6.—*Sitta carolinensis kinneari* from Guerrero; *Sitta carolinensis umbrosa* from Chihuahua; *Sitta pygmaea flavinucha* from Morelos; *Certhia familiaris guerrerensis* from Guerrero.

———. A Race of the Rivoli Hummingbird from Arizona and Northwestern Mexico. Ibid.:7-8.—*Eugenes fulgens aureoviridis* subsp. nov. from Chiricahua Mts., Cochise Co., Ariz.

——— and HACHISUKA. A Northwestern Race of the Mexican Cormorant. *Ibid.*: 9–10.—*Phalacrocorax olivaceus chancho* subsp. nov. from Sonora.

———. Descriptions of Two New Subspecies of Birds from Western Mexico. *Ibid.*:11-12.—*Vireo solitarius repetens* subsp. nov. from Guerrero; *Vermivora superciliosa palliata* subsp. nov. from Jalisco.

——— and HACHISUKA. A Race of the Military Macaw from Sonora. *Ibid.*: 13-14. —*Ara militaris sheffleri* subsp. nov. from Sonora.

———. Notes on Two Woodhewers from Mexico. *Ibid.*:15-16.—*Lepidocolaptes souleyetii guerrerensis* subsp. nov. from Guerrero; *Xiphorhynchus flavigaster megarhynchus* becomes *X. f. flavigaster* and the form hitherto known by that name becomes *X. f. eburneirostris*.

WITSCHI, EMIL, and RICHARD A. MILLER. Ambisexuality in the Female Starling. *Jour. Exper. Zool.*, 79, Nov., 1938: 475–87.

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NEW MEMBERS[1]

Sustaining Members

Barnes, Ventura, Jr., % William H. Phelps, Almacen Americano, Caracas, Venezuela 1938
Brandreth, Courtenay, Ossining, New York 1939
Welsh, William W., 76 Norfolk Rd., Clarendon Hills, Illinois..... 1939

Active Members

Armstrong, Miss Virginia, Musketaquid Rd., Concord, Massachusetts..... 1939
Ballard, Mrs. Rosamond Lockett, Avery Island, Louisiana..... 1939
Bartlett, Guy, Rosendale Rd., Route 1, Schenectady, New York..... 1938
Bennett, Miss Lillian V., Apt. C-4, 820 Addison St., Chicago, Illinois..... 1938
Bensinger, Arthur B., Dartmouth Apts., No. 5A, Louisville, Kentucky..... 1938
Blake, Emmet R[eid], Field Museum of Natural History, Chicago, Illinois.. 1939
Borden, Joseph Livezey, 307 Waverly Dr., Tulsa, Oklahoma..... 1938
Brooks, Frank G[ary], Cornell College, Mt. Vernon, Iowa..... 1939
Burch, Mrs. George D., 75 Woolnough Ave., Battle Creek, Michigan..... 1938
Carter, T[homas] C[hauncey], 729 Locust St., Alva, Oklahoma..... 1938
Clark, W. Kimball, Jr., Wildlife Conservation Bldg., University of Missouri, Columbia, Missouri 1939
Decker, C. O., 6450 Kenwood Ave., Chicago, Illinois..... 1938
Edeburn, Dr. R[alph] M[ilton], 1015 Second St., Beaver, Pennsylvania.... 1939
Emerson, Guy, 16 Wall St., New York, New York..... 1938
Gray, William Arthur, Room 690, 508 S. Dearborn St., Chicago, Illinois.... 1938
Griner, Lynn A[dell], Arrowhead Refuge, Kensal, North Dakota..... 1939
Hartshorne, Charles, 1124 E. 45th St., Chicago, Illinois..... 1938
Hill, Walter P., 409 6th Ave., La Grange, Illinois..... 1939
Johnson, Morton L., 446 49th Ave., Bellwood, Illinois..... 1938
Ludwig, Claud Charles, 506 Wilson Bldg., Lansing, Michigan..... 1938
Manweiler, J[ack], Soil Conservation Service, Baudette, Minnesota..... 1939
Mills, Mrs. Doris [Louise] Huestis, 84 Roxborough St., E., Toronto, Ontario, Canada 1938
Ohern, D. W., 515 N.W. 14th St., Oklahoma City, Oklahoma..... 1938
Park, Mrs. Laura Davidson, 1627 Sherwin Ave., Chicago, Illinois..... 1938
Pyle, George W[inner], Box 647, Berwyn, Pennsylvania..... 1939
Shackleford, Miss Martha Wheatty, Oklahoma College for Women, Chickasha, Oklahoma 1938
Stack, Joseph W., Zoology Dept., Michigan State College, East Lansing, Michigan .....(1925) 1938
Stegeman, Miss Thelma Isis, 1308 Geddes Ave., Ann Arbor, Michigan..... 1938
Stevenson, Bernard H., 2117 Woodford Ave., Ft. Myers, Florida..... 1938
Wagner, Fritz, Jr., 384 Hawthorne Lane, Winnetka, Illinois..... 1938
Worth, Dr. C[harles] Brooke, Dept. of Zoology, Swarthmore College, Swarthmore, Pennsylvania 1938

[1] This list of new members presents all new members who have joined the organization from June 1, 1938 to May 1, 1939. The Secretary would appreciate receiving notification of any omission of names, any errors in the spelling of names, the use of titles, or the exact years of election to membership. The Secretary wishes to have the full names of all new members.

Associate Members

Adams, Lowell, Yosemite, California 1938
Ahrens, Carsten, McKeesport High School, McKeesport, Pennsylvania 1938
Alikonis, Charles J., Ottawa High School, Ottawa, Illinois 1938
Anderson, John M., Ohio Wildlife Research Station, Ohio State University, Columbus, Ohio 1938
Anning, Mrs. Marion Street, 1925 Packard (Route 4), Ann Arbor, Michigan 1938
Anthes, Clarence A., 713 Hamilton Ave., Waukesha, Wisconsin 1939
Argabright, Miss LaVerne, Kalamazoo, Michigan 1938
Atwell, George C., Strafford, New Hampshire 1939
Ault, Harold, Box 476, Fiatt, Illinois 1938
Bach, Roy N., 615 W. Rosser St., Bismarck, North Dakota 1939
Baerg, William J., University of Arkansas, Fayetteville, Arkansas ....(1924) 1938
Baille, James Little, Jr., Royal Ontario Museum of Zoology, Queen's Park at Bloor St., Toronto, Ontario, Canada 1938
Baird, Dr. Don O., State Teachers College, Huntsville, Texas 1939
Baker, Bernard William, Marne, Michigan 1938
Baldwin, Mrs. Amy G., 6335 Kimbark Ave., Chicago, Illinois 1938
Baldwin, William Plews, Jr., 408 W. 26th St., Wilmington, Delaware 1938
Baumgartner, Dr Milton D., 430 Buckingham Dr., Indianapolis, Indiana 1938
Bay, J. C., % John Crerar Library, 86 East Randolph St., Chicago, Illinois.. 1939
Belcher, Paul Eugene, 928 Stoner St., Akron, Ohio 1938
Blyth, D. [Waller], Ohio Wildlife Research Station, Ohio State University, Columbus, Ohio 1938
Boggs, I. B., Morgantown, West Virginia 1938
Brigham, Edward Morris, Jr., Kingman Memorial Museum, Battle Creek, Michigan 1938
Brown, Clarence D., 222 Valley Rd., Montclair, New Jersey 1938
Cagle, Fred Ray, Southern Illinois Normal University, Carbondale, Illinois.. 1938
Capps, Beryl F[ranklin], 4921 Euclid, Kansas City, Missouri 1939
Carrothers, Miss Vera, 14704 Alder Ave., E. Cleveland, Ohio 1938
Case, Leslie Delos, Sr., 714 W. Madison St., Ann Arbor, Michigan 1938
Clark, Anthony Norris, 490 E. Abington Ave., Chestnut Hill, Philadelphia, Pennsylvania 1939
Cook, Kenneth, 308 N. Third St., Douglas, Wyoming 1938
Coombes, Robert Armitage Hamilton, Sea Bank, Bolton-le-Sands, Caraforth, Lancashire, England 1939
Creswell, Harry L., 149 Goldsboro Pl., N.E., Grand Rapids, Michigan 1938
Dear, Lieut. Col. L[ionel] S[extus], Box 127, Port Arthur, Ontario, Canada.. 1939
Dickinson, J[oshua] C[lifton], Jr., 1901 Brookline Ave., Tampa, Florida.... 1939
Dilley, Willard E., 927 Weschler Ave., Erie, Pennsylvania 1939
Emerson, David L[owell], 25 Everett Ave., Providence, Rhode Island 1939
Erickson, Ray Charles, 1104 Washington Ave., St. Peter, Minnesota 1939
Fales, John H[ouse], 1210 Grace Church Rd., Silver Spring, Maryland.... 1939
Farner, Donald S., Biology Bldg., Madison, Wisconsin 1939
Farrington, Miss Anna Gene, 1007½ W. Fourth St., Stillwater, Oklahoma .. 1939
Fisher, Martin L., 325 Vine St., West Lafayette, Indiana 1939
Ford, Edward R., Box 327, Newaygo, Michigan .....(1914) 1939
Ford, Miss Louise P., 'The Heights', Aiken, South Carolina 1938
Frey, Mrs. Edith K., 814 3rd St., Jackson, Michigan 1939
Fugo, Nicholas William, 5 E. Fairchild St., Iowa City, Iowa 1938
Gilligan, James P[ersh], 201 N. Thayer St., Ann Arbor, Michigan 1938
Gillihan, Mrs. T. M., River Falls, Wisconsin 1939
Godfrey, W. Earl, Wolfville, Nova Scotia, Canada 1938

Goodall, Lt.-Comd'r H. W., USN, % U.S. Navy Purchasing Agent, Shanghai, China, % Pm San Francisco, California 1939
Green, William E., Regional Game Manager, Pasadena, Texas 1939
Griggs, Julian G., 922 S. State St., Ann Arbor, Michigan 1939
Grose, E. R., Glenville, West Virginia 1939
Haak, A[drion], 437 Eugenie St., Norwood, Manitoba, Canada..... 1939
Happ, George B., Principia College, Elsah, Illinois..... 1939
Harris, Mrs. Hugh H., Emory University, Georgia 1939
Hausman, Dr. L[eon] A[ugustus], 259 Harrison Ave., New Brunskick, New Jersey 1939
Howell, [Louis] Moffitt, Route 1, Box 433, Jacksonville, Florida..... 1938
Howells, Mrs. Gertrude W., Mesilla Park, New Mexico 1939
Hubbard, Hugh W., American Board Mission, Paoting, Hopei, China..... 1939
Hutchens, Lynn H., Williow Springs, Illinois 1939
Jaques, F[rancis] L[ee], American Museum of Natural History, New York, New York 1939
Jenkins, James H., Wildlife Research Station, Ohio State University, Columbus, Ohio 1939
Jones, Howard A., Route 3, Fenton, Michigan 1938
Kahn, David C[urry], 1122 Michigan Ave., Ann Arbor, Michigan 1938
Kahn, Mrs. Dina Hope, 1122 Michigan Ave., Ann Arbor, Michigan 1938
Katz, David, Ohio Wildlife Research Station, Ohio State University, Columbus, Ohio 1938
Kramer, Theodore Christian, Dept. of Anatomy, East Medical Bldg., Ann Arbor, Michigan 1939
Kuitert, Louis Cornelius, 706 Florence St., Kalamazoo, Michigan 1938
Lacey, Miss Mifton H., No. 9 Ling Building, Canton, Ohio 1939
Laidlaw, A[lan] F., Soil Conservation Service, Independence, Wisconsin..... 1939
Larson, Adrian [Christopher], 611½ E. 14th St., Sioux Falls, South Dakota 1938
Leraas, Harold J., Pacific Lutheran College, Parkland, Washington 1939
Lewis, Dr. Harrison Flint, Lands Parks and Forest Branch, Dept. of Mines and Resources, Ottawa, Ontario, Canada 1939
Link, Rev. George M., 403 Centennial Bldg., Springfield, Illinois 1939
MacLean, Miss Dorothy W[illiams], 21 Ashley St., Hartford, Connecticut.... 1939
Manz, Frank J., Jr., 609 S. Water St., Northfield, Minnesota 1938
McCann, Lester J., Jackson, Wyoming 1939
McMurry, Frank B., Wichita Mountains Wildlife Refuge, Cache, Oklahoma 1939
Means, Amos Isaiah, Atwood, Illinois 1938
Merry, Miss Katherine, 117 College Ave., Ithaca, New York 1938
Messner, Clarence John, 236 McKinley St., Grosse Pointe, Michigan 1938
Michaud, Howard H[enry], 1205 Kensington Blvd., Fort Wayne, Indiana.. 1938
Miller, Douglas Scott, 122 Lawrence Ave., E., Toronto, Ontario, Canada.... 1939
Moore, George A., 1002 W. 4th St., Stillwater, Oklahoma 1938
Moore, Harvey, 102 Rex Ave., Chestnut Hill, Philadelphia, Pennsylvania.... 1939
Moore, Robert Thomas, Route 1, Box 28A, Pasadena, California..... 1938
Morrissey, W. W., Valentine, Nebraska 1939
Mullen, Miss Elizabeth, 203 S. Zitter Ave., Indianapolis, Indiana 1938
Myers, Frank Marcel, 1507 North E. St., Broken Bow, Nebraska 1939
Nattinger, Mrs. Maude C., 405 S. Holden St., Warrensburg, Missouri..... 1938
Neely, William W., 149 W. End St., Chester, South Carolina 1939
Neill, Miss Anna E[lizabeth], Spring Valley, Minnesota 1939
Nelles, Arthur D., 223 McLeod St., Ottawa, Ontario, Canada 1938
Nelson, Martin Knute, State Game Warden, Fertile, Minnesota 1939
Nelson, Urban C., Soil Conservation Service, Spring Valley, Minnesota 1939
Newcomb, Hugh Ross, General Delivery, Port Townsend, Washington 1939

Norris, Russell T[aplin], 1-A Horticulture Bldg., State College, Pennsylvania 1939
Painton, Dr. Harry R., 1000 Cowper Ave., Palo Alto, California 1939
Peattie, Donald Culross, 224 Buena Vista Rd., Santa Barbara, California.... 1938
Pell, S[tuyvesant] Morris, Laboratory of Ornithology, Cornell University, Ithaca, New York 1938
Porter, Thomas Wayne, 327 W. Water St., Oak Harbor, Ohio 1938
Pyke, Miss Mary Elizabeth, Dept. of Zoology, Michigan State College, East Lansing, Michigan 1938
Randall, Pierce E., 1-A Horticulture Bldg., State College, Pennsylvania..... 1939
Randall, Robert Neal, Georgetown, Colorado..... 1939
Reckhow, Alan Harding, 602 William St., Boonton, New Jersey 1938
Reneau, A. C. Jr., 601 No. 12th, Independence, Kansas 1939
Richardson, Mrs. William Devrick, 4215 Prairie Ave., Chicago, Illinois..... 1938
Riley, Gardner M., Zoology Dept., State University of Iowa, Iowa City, Iowa 1938
Risley, Paul Lemuel, Zoology Dept., State University of Iowa, Iowa City, Iowa 1938
Rowan, Dr. William, University of Alberta, Edmonton, Alberta, Canada.... 1939
Rowe, Kenneth Christopher, 513 Third St., Boonville, Missouri 1938
Rudd, R. L., 404 N. Main St., Salinas, California 1939
Schantz, William Edward, 1532 Aberdeen Ave., Columbus, Ohio..... 1938
Schaub, Miss Mary Hall, 1040 Isabella St., Wilmette, Illinois 1939
Scott, Walter Edwin, Refuge Section, Wisconsin Conservation Dept., Madison, Wisconsin 1938
Silliman, Oscar Perry, 224 W. Alesas St., Salinas, California 1939
Sime, P. R., Box 142, Canyon, Texas 1939
Smith, J. Donald, 222 Laurel Ave., Stillwater, Minnesota 1939
Smith, Harry R., 809 Michigan Ave., Evanston, Illinois 1939
Smith, H[erman] Granville, 1942 Iuka Ave., Columbus, Ohio 1938
Smith, Miss Maxine, 703 N. Court St., Rockford, Illinois 1938
Spencer, Miss O. Ruth, 845 18th Ave., Moline, Illinois 1938
Stark, Miss Wilma R[uth], 214 Charles St., East Lansing, Michigan 1939
Stevenson, H. Godwin, 7318 Bryan St., Mt. Airy, Philadelphia, Pennsylvania 1939
Stewart, Robert Earl, 4526 13th St., N. W., Apt. 2, Washington, D. C..... 1939
Street, J[ohn] Fletcher, 1120 Locust St., Philadelphia, Pennsylvania 1938
Terres, J[ohn] Kenneth, Soil Conservation Service, 121 E. State St., Ithaca, New York 1939
Towe, J. Tracy, Mt. Airy, North Carolina 1939
Trabue, Miss Ellie J., 1605 Mound Ave., Jacksonville, Illinois 1938
Turner, Mrs. W. A., 621 S. 18th St., Clarinda, Iowa 1939
Walker, Dr. Charles F., Stone Laboratory, Put-in-Bay, Ohio 1939
Whiting, R[obert] A[rch], Jackson High School, Jackson, Michigan 1938
Wilcox, Harry Hammond, Jr., Madison Ct., Ann Arbor, Michigan 1938
Wilson, Harold Charles, Ephraim, Wisconsin 1938
Woolfenden, Mrs. Harriett [Bargtold], 23635 Rockford Rd., Dearborn, Michigan 1938
Yeager, Lee E[mmett], Illinois Natural History Survey, Urbana, Illinois.... 1939

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